PROJECT MANUAL – VOL 1

Construction Documents

Delavan Public Library
Addition and Renovation

404 E Walworth Ave
Delavan, WI 53115

Volume 1 of 2

Divisions 01-14

FEH Project No. 2023403

7 April 2025

FEH DESIGN
ARCHITECTURE / ENGINEERING / INTERIORS

SIOUX CITY, IA 712 252 3889 / DES MOINES, IA 515 288 2000 / DUBUQUE, IA 563 583 4900 / MILWAUKEE, WI 414 200 9660

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SECTION 00 01 01
PROJECT TITLE PAGE

PROJECT MANUAL

FOR

DELAVAN PUBLIC LIBRARY ADDITION AND RENOVATION

FEH DESIGN PROJECT NUMBER: 2023403

CITY OF DELAVAN / DELAVAN PUBLIC LIBRARY
404 E. WALWORTH AVE
DELAVAN , WISCONSIN 53115

DATE: 04-07-2025

PREPARED BY:

FEH DESIGN

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SECTION 00 01 02
PROJECT INFORMATION

PART 1 GENERAL

1.01 PROJECT IDENTIFICATION

A. Project Name: Delavan Public Library Addition and Renovation, located at:

404 E. Walworth Ave.

Delavan, Wisconsin53115.

B. The Owner, hereinafter referred to as Owner / Library: City of Delavan or Delavan Public Library

1.02 NOTICE TO PROSPECTIVE BIDDERS

A. These documents constitute an Invitation to Bid to General Contractors for the construction of the project described below.

1.03 PROJECT DESCRIPTION

A. Summary Project Description: An addition and renovation to the existing Aram Public Library in Delavan, WI.

1.04 PROJECT CONSULTANTS

A. The Architect, hereinafter referred to as Architect:
1. Company: FEH DESIGN
2. Address: 951 Main Street.
3. City, State, Zip: Dubuque , IA 52001 .
4. Contact: Christy Monk, Daniel Rojano.
5. Phone/Fax: 563.583.4900.
6. E-mail: christym@fehdesign.com, danielr@fehdesign.com.

B. Structural Engineer
1. Company: FEH DESIGN
2. Address: 951 Main Street
3. City, State, Zip: Dubuque , IA 52001
4. Contact: Bryan Blair , Elliot Carlovsky
5. Phone/Fax: 563.583.4900
6. E-mail: bryanb@fehdesign.com , elliotc@fehdesign.com

C. Mechanical Engineer
1. Company: Henneman Engineering, Inc.
2. Address: 20855 Watertown Road , Suite 170
3. City, State, Zip: Waukesha , WI 53186
4. Contact: Jim Zadra
5. Phone/Fax: 262.901.0626
6. E-mail: jzadra@henneman.com

D. Electrical Engineer
1. Company: Henneman Engineering, Inc.
2. Address: 20855 Watertown Road, , Suite 170
3. City, State, Zip: Waukesha , WI 53186
4. Contact: Adam Abston
5. Phone/Fax: 262.901.0626
6. E-mail: aabston@henneman.com

E. Technology Engineer
1. Company: Henneman Engineering, Inc.
2. Address: 1241 John Q. Hammons Dr. Suite 503
3. City, State, Zip: Madison, WI 53717

4. Contact: Tim Cole
5. Phone: 608.833.7000
6. E-mail: tcole@henneman.com

F. Civil Engineer
1. Company: Snyder and Associates
2. Address: 5010 Voges Road
3. City, State, Zip: Madison , WI 53718
4. Contact: Scott Anderson
5. Phone: 608.838.0444
6. E-mail: sanderson@snyder-associates.com

G. Landscape Architect
1. Company: Snyder and Associates
2. Address: 5010 Voges Road
3. City, State, Zip: Madison , WI 53718
4. Contact: Andy Meessmann
5. Phone/Fax: 608.838.0444
6. E-mail: ameessmann@snyder-associates.com

1.05 PROCUREMENT TIMETABLE

A. Pre-Bid Meeting/Tour: 04-14-2025 at 3:00 PM

B. Last Request for Substitution Due: 7 days prior to due date of bids.

C. Last Request for Information Due: 7 days prior to due date of bids.

D. Bid Date: 05-07-2025

E. Bid Opening: Same day, after 10:00 AM local time bids due.

F. Bids May Not Be Withdrawn Until: 60 days after due date.

G. Desired Substantial Completion Date: 08-28-2026

H. Desired Final Completion Date: Not later than 30 calendar days past Substantial Completion.

I. The Owner / Library reserves the right to change the schedule or terminate the entire procurement process at any time.

1.06 PROCUREMENT DOCUMENTS

A. Availability of Documents: Complete sets of procurement documents may be obtained:
1. At the following address: www.cityblueplanroom.com.
2. At the following address:
   a. CityBlue Technologies
   b. 4653 44th Street
   c. Rock Island , IL 61201
   d. 800.747.6500

B. Documents are available at the following construction plan rooms:
1. Builders Association of Missouri, 720 Oak Street, Kansas City, Missouri 64106
2. Builders Exchange of Rochester, 108 Elton Hills Lane NW, Rochester, MN 55901
3. Central Illinois Plan Room, 1620 S. 5th Street, Springfield, IL 62703
4. Construct Connect, 28 N. Clark Street, Suite 450, Chicago, IL 60602
5. LaCrosse Builders Exchange, 427 Gillette Street, La Crosse, WI 54603
6. Master Builders of Iowa, 221 Park St., Des Moines, IA 50303
7. Minnesota Builders Exchange, 1123 Glenwood Ave., Minneapolis, MN 55405
8. North Iowa Builders Exchange, 15 W. State St, P. O. Box 1128, Mason City, IA 50401
9. Omaha Builders Exchange, 4159 South 94th Street, Omaha, NE 68127
10. Springfield Blueprint, 1620 S Fifth Street, Springfield, IL 62703
11. Northern Illinois Building Contractors Association, info@nibca.build

1.07 BID SECURITY

A. Bids shall be accompanied by a security deposit as follows:
   1. Bid Bond of a sum no less than 5 percent of the Bid Amount on AIA A310 Bid Bond Form. Or
   2. Certified check in the amount of no less than 5 percent of the Bid Amount.

PART 2 PRODUCTS (NOT USED)

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END OF SECTION

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END OF SECTION

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SECTION 00 11 13
ADVERTISEMENT FOR BIDS

FROM:

1.01 THE OWNER / LIBRARY (HEREINAFTER REFERRED TO AS OWNER / LIBRARY):

A. City of Delavan / Delavan Public Library

B. Address:
404 E. Walworth Avenue
Delavan, Wisconsin 53115

1.02 AND THE ARCHITECT (HEREINAFTER REFERRED TO AS ARCHITECT):

A. FEH DESIGN

B. Address:
951 Main Street
Dubuque , IA 52001

C. Architect's Project Number: 2023403

1.03 BIDS DUE

A. Date: 05-07-2025

B. Time: Until 10:00 AM local time

C. Location:
Delavan City Hall / City Clerk
123 South Second Street
Delavan , WI 53115

1.04 NOTICE IS HEREBY GIVEN:

A. Sealed bids for the Delavan Public Library Addition and Renovation will be received by the City of Delavan .

B. Bids will be publicly opened by the Owner / Library and publicly read by the Owner / Library or designee, on said date and will be acted upon by the Owner / Library at such later time and place as may then be fixed. Award of the Contract shall be to the lowest responsive, responsible bidder determined on the basis of a combination of the Base Bid and selected Alternates. Neither the Owner / Library nor its agents will assume liability for the inability of the bidder to submit a bid in a timely manner. Bids received after the deadline will be rejected. Bidders bear full and complete responsibility for the timely submission of such bid. Time of receipt shall be the time recorded and determined by the Library or designee.
   1. Regulatory Requirements: Bidder certifies that all laws of the State of Wisconsin and ordinances of the City of Delavan in effect at the date of bidding shall be observed by bidder.
   2. Bids are anticipated to be reviewed by the Library Board of Trustees on 5/15/2025.
   3. Bids are anticipated to be reviewed and the project potentially awarded during the City of Delavan Common Council on 5/20/2025.

C. **ALL BIDDERS ARE REQUIRED TO OBTAIN AND COMPLY WITH THE REQUIREMENTS IN THE INVITATION TO BID DOCUMENTS.**

1.05 TO: POTENTIAL BIDDERS

A. Project: Delavan Public Library Addition and Renovation

B. Project Scope: The Work of the Project is defined by the Contract Documents and consists of the following:
   1. An addition and renovation to the existing Aram Public Library in Delavan, WI.

C. Bids will be received for the following:

1. General Contract, including Architectural, Structural, Mechanical, Electrical, Technology, Civil, Landscaping, Fire Protection, and Plumbing .

D. All bids shall be in accordance with Contract Documents prepared by FEH DESIGN , Which Contract Documents are made a part of this Advertisement by reference thereto.

E. Bidders can obtain digital bidding documents, from CityBlue Technologies. Planroom: www.cityblueplanroom.com. Address: CityBlue Technologies, Attn: DPC, 4653 44th Street, Rock Island, IL61201. Phone: 800.747.6500. The contractor is responsible for purchasing hard copies, upon request of the printing company.

F. **Send all checks to CityBlue Technologies , if required.**

G. Bidding documents will be available for pickup/ordering after 04-07-2025 .

H. Bidding documents are on file at the Architect 's Office, 951 Main Street , Dubuque , IA 52001 ; and at the following Plan Centers:
1. Builders Association of Missouri, 720 Oak Street, Kansas City, Missouri 64106
2. Builders Exchange of Rochester, 108 Elton Hills Lane NW, Rochester, MN 55901
3. Central Illinois Plan Room, 1620 S. 5th Street, Springfield, IL 62703
4. Construct Connect, 28 N. Clark Street, Suite 450, Chicago, IL 60602
5. LaCrosse Builders Exchange, 427 Gillette Street, La Crosse, WI 54603
6. Master Builders of Iowa, 221 Park St., Des Moines, IA 50303
7. Minnesota Builders Exchange, 1123 Glenwood Ave., Minneapolis, MN 55405
8. North Iowa Builders Exchange, 15 W. State St, P. O. Box 1128, Mason City, IA 50401
9. Omaha Builders Exchange, 4159 South 94th Street, Omaha, NE 68127
10. Springfield Blueprint, 1620 S Fifth Street, Springfield, IL 62703
11. Northern Illinois Building Contractors Association, info@nibca.build

The Planholder's List may be viewed on-line at www.cityblueplanroom.com .

Some plan centers may include the documents on their respective electronic sites. Check with the individual plan centers to verify.

I. **BIDDING REQUIREMENTS**
1. Each Bid shall be made on a form furnished by the Architect , and must be accompanied by a certified check or cashier's check drawn on an Wisconsin bank, or Bid Bond to be executed by corporation authorized to contract as a surety in the State of Wisconsin , in the amount equal to five percent (5%) of the amount of the Bid, made payable to the City of Delavan , Delavan , WI and may be cashed by the Owner / Library as liquidated damages in the event that the successful bidder fails to enter into a Contract and file a bond satisfactory to the Owner / Library assuring the faithful fulfillment of the Contract and maintenance of said improvements as required by the law, the provisions of this Notice and Contract Documents within (10) days after acceptance of the lowest responsive, responsible bid. All bids shall be sealed and plainly marked. Any alteration of the Bid Form may be cause for rejection of the bid.
2. **State Sales Tax:** This project is tax exempt. **Do Not** include State Sales Tax in any calculation of Bid totals. Contractor will be provided with WI sales tax exemption number for this project.

J. **BIDDER'S QUALIFICATIONS**
1. Bidders must be properly licensed under the laws governing their respective trades and be able to obtain insurance and bonds required for the Work. A Performance Bond, separate Labor and Material Payment Bond, and Insurance in a form acceptable to Owner will be required of the successful Bidder.
2. Bidders may qualify to submit bids or proposals, only if they are a legal entity authorized to do business in Wisconsin prior to submitting the bid, offer, or proposal. This applies to both in-state and out-of-state firms.

K. **BASIS OF BIDS**

1. The successful Bidder will be required to furnish a Performance Bond and Labor and Material Payment Bond in an amount equal to one hundred percent (100%) of the Contract Sum, issued by a responsible Surety approved by the Owner / Library and shall guarantee the faithful performance of the Contract and terms and conditions therein contained and the maintenance of said improvements pursuant to the provisions of the Contract Document. Bid Security shall be made payable to City of Delavan , Delavan , WI .
2. Bid Security of two lowest Bidders will be retained until a contract has been awarded and executed, but no longer than 60 days. No Bidder may withdraw their bid within 60 days after opening of bids.
3. City of Delavan , reserves the right to reject any and all bids, re-advertise for new bids, and to waive informalities that may be in the best interest of City of Delavan .
4. The bidder shall insert the prices on the Bid Form. The prices inserted shall be net and shall be the full, delivered cost, including all factors whatsoever. No permits shall be waived. The contractor shall be responsible to pay for all required permits to accomplish the work.
5. The City of Delavan reserves the right to negotiate with the apparent low bidder to reduce the overall project cost.
6. Payment will be made by City of Delavan from cash-on-hand from such sources as may be legally available.
7. Monthly estimates will be paid to the Contractor as the work progresses in amounts equal to ninety-five percent (95%) of the Contract value of the work completed during the preceding calendar month, including the actual cost (exclusive of overhead or profit to the Contractor) of materials and equipment of a permanent nature to be incorporated in the work and delivered to and stored at the job site. Such monthly payments shall in no way be construed as an act of acceptance for any part of the work, partially or totally completed. Final payment of the five percent (5%) due each Contractor will be made upon final acceptance of the work under the respective Contract by the Owner / Library , and after receipt of satisfactory evidence that all claims pertaining to such Contract have been paid in full as provided in the Contract Document for said work.
8. The work under the Contract shall be commenced on or before a date to be specified in the Contract or written Notice to Proceed of the Owner, and shall achieve Substantial Completion by 08-28-2026.
9. The successful bidder is prohibited from assigning, transferring, conveying, subletting, or otherwise disposing of the contract to be signed or its rights, title or interest therein or its power to execute such Agreement to any other person, company or corporation without the previous consent and approval, in writing, by the Aram Public Library Board of Trustees.
10. All bids will be governed by applicable provisions in the WI Code and City Policies.
11. Project funding is partially provided by Rural Development through the USDA. The contract and modifications thereto must be reviewed and approved by the USDA.

L. **PRE-BID MEETING/TOUR:**

1. A Pre-Bid Meeting/Tour for interested bidders will be on 04-14-2025 at 3:00 PM local time at 404 E. Walworth Avenue , Delavan , WI 53115 in the Aram Public Library . All prospective bidders are encouraged to be present at this Pre-Bid Meeting/Tour. A walk through tour will follow.
2. Each bidder shall visit the site to familiarize themselves with conditions under which they will operate. All interested parties in attendance at the pre-bid meeting will sign the attendance form. There are no provisions for any additional dates for site visits.

M. **REJECTIONS**

1. The Owner / Library reserves the right to accept or reject any or all offers.

END OF SECTION

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SECTION 00 21 13
INSTRUCTIONS TO BIDDERS

SUMMARY

1.01 INSTRUCTIONS TO BIDDERS

A. AIA Document A701, "Instructions to Bidders," is hereby incorporated into the Procurement and Contracting Requirements by reference.

B. This form can be purchased from the American Institute of Architect's State office at cost. Wisconsin Chapter - 321 S Hamilton Street, Madison, WI 53703

C. Refer to Document 00 2213 Supplemental Instructions to Bidders for additional information that supplements, modifies or adds to the AIA Instructions to Bidders. Where any part of the Instructions for Bidders is modified, the unaltered provision of that part shall remain in effect.

D. Refer to the Procurement and Contracting Documents for specific information regarding the following:
   1. Bid Submittal information and Bid Form
   2. Required Bid Submittals
   3. Bid Pricing - Terms and Conditions

END OF SECTION

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SECTION 00 22 13
SUPPLEMENTAL INSTRUCTIONS TO BIDDERS

1.01 INSTRUCTIONS TO BIDDERS

A. The "Instructions to Bidders" AIA Document A701, 2018 Edition, Articles 1 through 8 inclusive, is a part of this Contract, a copy of which is available at cost from the office of the American Institute of Architects, Wisconsin Chapter, 321 S Hamiltn Street, Madison, WI 53703.

1.02 SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

A. The following supplements modify or add to the AIA Instructions to Bidders. Where any part of the Instructions to Bidders is modified, the unaltered provisions of that part shall remain in effect.

1.03 MODIFIED INSTRUCTIONS

A. Article 1: Definitions
   1. Modify paragraph 1.1 to include the Notice to Bidders as part of the Bidding Documents.

B. Article 2: Bidder's Representations
   1. Add the following clause 2.1.3.1
      a. 2.1.3.1 The Bidder has investigated all the required fees, permits, and regulatory requirements of authorities having jurisdiction and has properly included in the submitted Bid, the cost of such fees, permits and requirements not otherwise indicated as provided by Owner.
   2. Add the following subparagraph 2.1.5
      a. 2.1.5 The Bidder is a properly licensed Contractor according to the laws and regulations of the State of Wisconsin and meets qualifications indicated in the Procurement and Contracting Documents.
   3. Add the following subparagraph 2.1.6
      a. 2.1.6 The Bidder has incorporated into the Bid adequate sums for work performed by installers whose qualifications meet those indicated in the Procurement and Contracting Documents.

C. Article 3: Bidding Documents
   1. 3.2 Interpretation or Correction of Bidding Documents - Add the following subparagraphs:
      a. 3.2.4 in the case of errors, inconsistencies, or ambiguities in the Bidding documents not interpreted or clarified by addendum or discovered too late for an addendum, the following applies:
         1) The better quality or greater quantity of Work shall be provided.
         2) To the best of their ability, the Bidders shall determine the proper methods or materials to fulfill the design intent of the Bidding Documents and include the cost of providing such methods in the Bid.
         3) Failure to request clarification will not waive the responsibility of comprehension of the documents and performance of the Work in accordance with the intent of the documents. Signing the Agreement will be considered as thorough comprehension of intent of the Bidding Documents.
      b. 3.2.5 The following consultants to the Architect were involved or responsible for the indicated phases or divisions of the Work, and are listed herein as a convenience to the Bidders.

         1) Mechanical Engineering:

(a) Henneman Engineering, Inc.
(b) 20855 Watertown Road
(c) Suite 170
(d) Waukesha , WI 53186
(e) 262.901.0626
(f) Attention: Jim Zadra

2) Electrical Engineering:
(a) Henneman Engineering, Inc.
(b) 20855 Watertown Road,
(c) Suite 170
(d) Waukesha , WI 53186
(e) 262.901.0626
(f) Attention: Adam Abston

1) Civil Engineering:
(a) Snyder and Associates
(b) 5010 Voges Road
(c) Madison , WI 53718
(d) NOT USED
(e) Attention: Scott Anderson

1) Landscape Architect
(a) Snyder and Associates
(b) 5010 Voges Road
(c) Madison , WI 53718
(d) 608.838.0444
(e) Attention: Andy Meessmann

2. Add the following paragraph:
a. 3.5 Contracts
1) 3.5.1 The Owner invites the following Bids: Single Prime Contract

B. Article 4: Bidding Procedures
1. 4.1
a. Delete the first sentence in Subparagraph 4.1.6.
b. Delete the word “additional” in the second sentence of 4.1.6.
2. 4.2 Bid Security
a. Add the following to Subparagraph 4.2.1:
1) Each Bid shall be accompanied by a certified check, cashier's check, certified share draft or Bid Bond in the amount equal to five percent (5%) of the amount of the Bid as a guarantee that the Bidder will furnish a one hundred percent (100%) Performance Bond and a Labor and Material Payment Bond, and will enter into a Contract with the Owner in accordance with the terms of the Bid within (10) calendar days after receipt of the notice of award. Bid security shall be made payable to the City of Delavan . Bidders shall use AIA Document A310 - Bid Bond, or another corporate form approvable to the City of Delavan
b. Add the following to Subparagraph 4.2.2:
1) As soon as the Bids have been checked and compared, the Owner may, at its discretion, return the bid security accompanying those Bids that in Owner’s judgment would not be considered in making the award. When award is made, the Bid security of the two (2) lowest responsive, responsible Bidders will be retained until the Contract and Bonds have been executed and the Contract approved by the Owner. Should the award be delayed more than sixty (60) days

after opening of the Bids, all Bid security will be returned, unless such delay is from cause beyond the control of the Owner.

3. 4.3 Submission of Bids
   a. Add the following to Subparagraph 4.3.1:
      1) Submit Bid and Bid security in separate opaque, sealed envelopes with: (1) Project name and (2) name of Bidder. Label one envelope "Bid Form" and the other envelope "Bid Security."
   b. ADDRESS BIDS TO:
      1) Delavan City Hall / City Clerk
      2) 123 South Second Street
      3) Delavan , WI 53115
      4) BIDS DUE: **05-07-2025 at 10:00 AM local time**
   c. MAILED BIDS: Sent to address indicated above.
   d. HAND CARRIED BIDS: Deliver to address indicated above.
   e. Bids will be publicly opened and read directly after the Bid Due time by the City Clerk.
   f. Add the following Subparagraph 4.3.6
      1) Bidders are hereby given notice to check carefully the accuracy and arithmetic of their bids before submission. Errors in bids may result in rejection of that bid and award to the next low bidder and disposition of bid security is at the discretion of the Owner.

4. 4.4 Modification or Withdrawal of Bid
   a. Add the following to Subparagraph 4.4.1:
      1) No Bid may be withdrawn within sixty (60) days from the scheduled date for receipt of Bids.

C. Article 5: Consideration of Bids
   1. Acceptance of Bid (Award)
      a. Amend the first sentence to read as follows: “It is the intent of the Owner to award a Contract to the lowest responsive, responsible Bidder determined on the basis of a combination of the base bid and selected alternates provided the Bid has been submitted in accordance with the requirements of the Bidding Documents and does not exceed the funds available.”

D. Article 6: Post Bid Information
   1. 6.3 Submittals
      a. 6.3.1 Delete the words "as soon as practicable after" (in the first line) and substitute the words "within seven (7) days of".

E. Article 7: Performance Bond and Labor and Material Payment Bond
   1. Modify Subparagraph 7.1.1 as follows:
      a. 7.1.1 The Contractor shall furnish in duplicate a Performance Bond, Maintenance Bond and Labor and Material Payment Bond, each in the amount of one hundred percent (100%) of the Contract Sum, issued by a responsible surety approved by the Owner. Bidders shall use bid bond forms included in the specifications or of a corporate form approvable to the City of Delavan . Performance Bond and Payment Bond AIA Document A312.
      b. Modify the first sentence of Subparagraph 7.2.1 as follows:
         1) .1 The Bidder shall deliver the required bonds to the Owner, together with the executed Owner-Contractor Agreements, not later than seven (7) days following the date of the Contract award.

1.02 ADDITIONAL PROVISIONS

A. Add the following provisions, as indicated:
   1. Article 9: Additional Instructions
      a. 9.1 Preparation of Bids
         1) 9.1.1 Bids shall be submitted on the prescribed form and shall be subject to all requirements of the Contract Documents and these INSTRUCTION TO BIDDERS. The Bidder must bid all of the Alternates, if any are listed. Special care shall be exercised in the preparation of Bids. All Bids must be regular in every respect and no interlineations, excisions, or special conditions shall be made or included in the bid form of the Bidder.
         2) 9.1.2 Each Bid shall furnish the full business name, business address, and treasury member of the person, firm, or corporation submitting the Bid. The signature of the person signing a Bid shall be the usual signature of that person, and the name of each person signing a Bid shall be typed or printed below the signature.
         3) 9.1.3 A Bid by an Individual shall furnish their full name and complete address.
         4) 9.1.4 A bid by a Partnership shall furnish the full name and complete home address of each partner. A Bid by a partnership shall be signed with the partnership's name by one of the members of the partnership or by an authorized representative, followed by the signature and designation of the person signing the Bid.
         5) 9.1.5 A Bid by a Corporation shall be signed with the legal name of the corporation, followed by the State of Incorporation and by the signature of the president, secretary, or other person authorized to bind it in the matter. When requested by the Owner, satisfactory evidence of authority of the officer signing on behalf of a corporation shall be furnished. Attached to a Bid by a corporation shall be a list containing the name and complete home address of each principal officer of the corporation.
         6) 9.1.6 The Owner may consider as irregular any Bid on which there is an alteration of or departure from the Bid Form hereto attached and at its option may reject the same.
         7) 9.1.7 Bidders shall carefully examine the Bidding Documents and construction site to obtain firsthand knowledge of existing conditions. The Contractors will not be given extra payments for conditions which can be determined by examining the site and Bidding Documents.
      b. 9.2 Errors In Bid
         1) 9.2.1 Bidders or their authorized agents are expected to examine all Contract Documents, Drawings, Specifications, circulars, schedules, and other instructions pertaining to the Work. Failure to do so will be at the Bidder's own risk and he cannot secure relief on the plea of error in the Bid.
      c. 9.3 Disqualification of Bidder
         1) 9.3.1 Any one or more of the following causes may be considered as sufficient for the disqualification of a Bidder and the rejection of his Bid:
         2) 9.3.1.1 More than one bid for the same work from an individual, firm, partnership, or corporation under the same or different names.
         3) 9.3.1.2 Evidence of collusion among Bidders. (Participants in such collusion may receive no recognition as Bidders for any future work.)
         4) 9.3.1.3 Lack of responsibility as evidenced by poor workmanship and progress of past work.
         5) 9.3.1.4 Incomplete work that in the judgment of the Owner might hinder or prevent the prompt completion of additional work if awarded.
         6) 9.3.1.5 For being in arrears on existing contracts, in litigation with the Owner, or having defaulted on a previous contract.

d. 9.4 Approval of Contract
   1) 9.4.1 No contract is binding upon the Owner until it has been executed by and approved by the Owner and delivered to the Contractor and the Contract Bond has been filed with the City of Delavan , and approved.
e. 9.5 Award
   1) 9.5.1 The Owner will select the Bid that it deems most reasonable and in its best interest in terms of cost, quality, appearance, performance of the Contractor and the Contractor's proximity to the site and his ability to service the Project after it has been completed.
   2) 9.5.2 The Contract will be awarded based on the above qualifications to the lowest responsive, responsible Bidder for the lowest combination of Base Bid and selected Alternates.
   3) 9.5.3 The City of Delavan , Delavan , WI , reserves the right to reject any and/or all Bids and waive any or all informalities, as authorized by law, in connection therewith and shall award the Bid based on the best interests of the Owner.
f. 9.6 Contract Time
   1) 9.6.1 Bidder agrees to commence Work as soon as possible on or before 10 days after receiving a written "Notice to Proceed" from the Owner, and to substantially complete the Project as soon as possible. The dates of substantial completion shall be so stated by the Construction Bidder in the space provided on the BID FORM and in compliance with project schedule.
g. Sales and Use Tax
   1) 9.7 The Bidder shall not include in the bid State of Wisconsin Tax for building materials that will be incorporated into real property for this project. Each Contractor shall provide a list of subcontractors and sub-sub contractors with their Federal Identification Number to the Owner, The Owner will issue exemption certificates to contractors, subcontractors, sub-sub contractors and suppliers in order to eliminate tax from the construction materials following award of contracts. If material is purchased outside the state of Wisconsin and the other State requires that the contractors, subcontractors, and sub-sub contractors and suppliers pay sales tax they are recommended to include this price in their Bid unless they are able to obtain a sales tax refund from said State.
h. Law and Regulations
   1) 9.8 The Bidder’s attention is directed to the fact that all applicable state laws, municipal ordinances and the rules and regulations of all authorities having jurisdiction over construction of the Contract are applicable the same as though herein written out in full.

END OF SECTION

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SECTION 00 31 00
AVAILABLE PROJECT INFORMATION

PART 1 GENERAL

1.01 EXISTING CONDITIONS

A. Certain information relating to existing surface and subsurface conditions and structures is available to bidders for convenience and information, but will not be part of Contract Documents, as follows:

B. Geotechnical Report: Entitled Geotechnical Engineering Report: Proposed Aram Public Library Addition (rev 2), dated March 6, 2025.
   1. This report identifies properties of below grade conditions and offers recommendations for the design of foundations, prepared primarily for the use of Architect.
   2. This report, by its nature, cannot reveal all conditions that exist on the site. Should subsurface conditions be found to vary substantially from this report, changes in the design and construction of foundations will be made, with resulting credits or expenditures to the Contract Sum accruing to Owner / Library.
   3. This information is provided for Bidders' convenience and is intended to supplement rather than serve in lieu of the Bidders' own investigation.

C. Existing Drawings: Entitled Addition/Renovation Aram Public Library, dated Feb. 28, 1990
   1. Existing Drawings from the south addition to the original library building.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

3.01 OBTAINMENT OF PERMITS

A. Contractor to obtain the following required permits, at no cost to Owner / Library:
   1. Building Permit for all trades. The permit fees will be waived by the City of Delavan. A permit application submission is required by the contractor.
   2. Any other permit required to conduct work outlined in the bid documents.

END OF SECTION

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SECTION 00 41 00
BID FORM

THE PROJECT AND THE PARTIES

1.01 TO:

A. City of Delavan (Owner / Library)
404 E. Walworth Avenue
Delavan , WI 53115

1.02 FOR:

A. Project: Delavan Public Library Addition and Renovation

B. Project Number: 2023403

C. BIDS DUE: Wednesday, May 7, 2025 (05-07-2025) at 10:00 AM local time.

D. BID LOCATION:
1. Delavan City Hall / City Clerk
2. 123 South Second Street
3. Delavan , WI 53115

1.03 SUBMITTED BY: (BIDDER TO ENTER NAME AND ADDRESS)

A. Bidder's Full Name _____
1. Address _____
2. City, State, Zip_____
3. Date_____
4. Phone_____

1.04 OFFER

A. The Bidder, in compliance with Advertisement for Bid for the Delavan Public Library Addition and Renovation , having examined the drawings and specifications with related documents and the site of the proposed work, and being familiar with all of the conditions surrounding the construction of the proposed Project, including the availability of materials and labor, hereby proposes to furnish all labor, materials, equipment and supplies and to deconstruct and demolish the Project in accordance with the Contract Documents, within the time set forth therein, and at the prices stated below.

B. Bidder agrees to perform all of the Contract Work, including architectural, structural, mechanical, electrical, civil, landscaping, and technology work, described in the Specifications and shown on the Drawings for the sum of:

1. _____Dollars
(Bidder to write out amount in text)

2. $_____
(Bidder to write out amount in numbers)

In the case the sums listed above differ, the lowest amount listed will be used.

C. Accompanying this Bid is a certified check, cashier's check, or Bid Bond as Bid Security, as required by the Bidding Documents.

D. All Cash and Contingency Allowances described in Section 01 21 00 - Allowances are **INCLUDED** in the Bid Sum.

1.05 ACCEPTANCE

A. This offer shall be open to acceptance and is irrevocable for Sixty days from the bid closing date.

B. If this bid is accepted by Owner / Library within the time period stated above, we will:
   1. Execute the Agreement within seven days of receipt of Notice of Award.
   2. Furnish the required bonds within seven days of receipt of Notice of Award.

C. If this bid is accepted within the time stated, and we fail to commence the Work or we fail to provide the required Bond(s), the security deposit shall be forfeited as damages to Owner / Library by reason of our failure, limited in amount to the lesser of the face value of the security deposit or the difference between this bid and the bid upon which a Contract is signed.

D. In the event our bid is not accepted within the time stated above, the required security deposit shall be returned to the undersigned, in accordance with the provisions of the Instructions to Bidders; unless a mutually satisfactory arrangement is made for its retention and validity for an extended period of time.

E. The Owner / Library reserves the right to reject any or all bids submitted, re-advertise for new bids, and to waive any informalities therein in the best interest of City of Delavan and the Aram Public Library Board of Trustees.

1.06 CONTRACT TIME

A. Substantial Completion:
   1. All work required by the Contract Documents for Delavan Public Library Addition and Renovation shall achieve Substantial Completion by Friday, 28 August 2026 (08-28-2026).

B. In lieu of date indicated above, Bidder proposes that all work required by the Contract Documents shall achieve Substantial Completion by the date indicated below.
   1. Bidder Proposed Substantial Completion Date:_____

1.07 UNIT PRICES

A. Unit Price #1: Subgrade Stabilization Excavation :

_____Dollars $_____ Unit: _____

B. Unit Price #2: Subgrade Stabilization Backfill :

_____Dollars $_____ Unit: _____

1.08 ALTERNATES

A. Alternate #1: Existing Building Mechanical Upgrades

_____Dollars. Add/Deduct $_____

B. Alternate #2: Irrigation System

_____Dollars. Add/Deduct $_____

1.09 IN KIND CONTRIBUTIONS

A. The base bid includes and reflects in-kind contributions from the following contractors and suppliers:
   1. Contractor _____ In-Kind Amount: $ _____.
   2. Contractor _____ In-Kind Amount: $ _____.
   3. Contractor _____ In-Kind Amount: $ _____.
   4. Contractor _____ In-Kind Amount: $ _____.
   5. Contractor _____ In-Kind Amount: $ _____.

1.10 ALLOWANCE

A. The base bid **includes** those allowances described in the Contract Documents which is scheduled in section 01 21 00 "Allowances".

1.11 ADDENDA

A. The following Addenda have been received. The modifications to the Bid Documents noted below have been considered and all costs are included in the Bid Sum.
   1. Addendum # _____ Dated _____.
   2. Addendum # _____ Dated _____.

3. Addendum # _____ Dated _____.
4. Addendum # _____ Dated _____.
5. Addendum # _____ Dated _____.
6. Addendum # _____ Dated _____.

1.12 CONTRACTOR'S LICENSE

A. The undersigned further states that it is a duly licensed contractor, for the type of work proposed, in Delavan, WI and that all fees, permits, etc pursuant to submitting this proposal have been paid in full.

1.13 INSURANCE

A. The undersigned agrees to provide Liability Insurance, Workmen's Compensation Insurance, Employer's Liability, as required by applicable Federal, State, and Local Laws, and in the amounts specified. Certificates shall be filed with the Owner prior to commencement of the Work.

1.14 TAXES

A. The undersigned certifies that all of the prices stated above do not include Wisconsin State Sales and Retailers Occupational Tax.

1.15 SUBCONTRACTOR IDENTIFICATION

A. Heating, Ventilation, & Air Conditioning Subcontractor _____.
B. Plumbing Subcontractor _____.
C. Electrical Subcontractor _____.
D. Masonry Subcontractor _____.
E. Concrete Subcontractor _____.
F. Fire Protection Subcontractor_____.
G. Photovoltaic Subcontractor _____.
H. Roofing Subcontractor _____.

1.16 BID FORM SIGNATURE(S)

A. The Corporate Seal of
B. _____
C. (Bidder - print the full name of your firm)
D. was hereunto affixed in the presence of:
E. _____
F. (Authorized signing officer, Title)
G. Signed and sealed this _____day of _____, 2025 .
H. Legal Classification: The undersigned does hereby declare that the Proposer has the legal status checked below.
   1. _____ Individual
   2. _____ Co-Partnership
   3. _____ Corporation Incorporated under the Laws of the State of Wisconsin .

END OF SECTION

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SECTION 00 50 00
CONTRACTING FORMS AND SUPPLEMENTS

PART 1 GENERAL

1.01 CONTRACTOR IS RESPONSIBLE FOR OBTAINING A VALID LICENSE TO USE ALL COPYRIGHTED DOCUMENTS SPECIFIED BUT NOT INCLUDED IN THE PROJECT MANUAL.

A. AIA Forms can be purchased from the American Institute of Architect's State office at cost.
   1. American Institute of Architects - Wisconsin
      a. 321 S Hamilton Street, Madison, WI 53703

1.02 AGREEMENT AND CONDITIONS OF THE CONTRACT

A. AIA Document A101-2017 "Standard Form of Agreement between Owner and Contractor Where the Basis of Payment is a Stipulated Sum"

B. See Section 00 72 00 - General Conditions for the General Conditions incorprated by reference.

C. See Section 00 73 00 - Supplementary Conditions for the Supplementary Conditions.

1.03 FORMS

A. Use the following forms for the specified purposes unless otherwise indicated elsewhere in Contract Documents.

B. Bond Forms:
   1. Bid Bond Form: AIA A310.
   2. Performance and Payment Bond Form: AIA A312.

C. Post-Award Certificates and Other Forms:
   1. Certificate of Insurance Form: ACORD Certificate of Insurance 25.
      a. Supplemental Attachment: AIA G715
   2. Schedule of Values Form: AIA G703.
   3. Application for Payment Forms: AIA G702 with AIA G703 (for Contractors).

D. Clarification and Modification Forms:
   1. Architect's Supplemental Instructions Form: AIA G710-1992.
   2. Construction Change Directive Form: AIA G714.
   3. Work Changes Proposal Request Form: AIA G709-2001.
   4. Change Order Form: AIA G701.

E. Closeout Forms:
   1. Closeout Form: See Section 01 77 10 included in this Project Manual.
   2. Contractor’s Affidavit of Release of Liens Form: AIA G706A
   3. Consent of Surety to Final Payment Form: AIA G707.

1.04 REFERENCE STANDARDS

A. AIA A310 - Bid Bond; 2010.

B. AIA A312 - Performance Bond and Payment Bond; 2010.

C. AIA G701 - Change Order; 2017.

D. AIA G702 - Application and Certificate for Payment; 1992.

E. AIA G703 - Continuation Sheet; 1992.

F. AIA G706A - Contractor’s Affidavit of Release of Liens; 1994.

G. AIA G707 - Consent of Surety to Final Payment; 1994.

H. AIA G709 - Proposal Request; 2018.

I. AIA G709-2001 - Proposal Request; 2001.

J. AIA G715 - Supplemental Attachment for ACORD Certificate of Insurance 25; 2017.

K. AIA G710-1992 - Architect's Supplemental Instructions; 1992.

L. AIA G710 - Architect's Supplemental Instructions; 2017.

M. AIA G714 - Construction Change Directive; 2017.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 00 50 01
STANDARD FORM OF AGREEMENT ALTERATIONS

1 - GENERAL

1.01 STANDARD FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR

A. American Institute of Architects - AIA Form A101 – 2017

1.02 MODIFICATIONS:

A. The following modifications shall be made to AIA Document A101 – 2017 for purposes of the Contract Documents and this Agreement:
   1. Section 8.7. Notwithstanding anything to the contrary in AIA Document A201-2017, Owner shall have no obligation to pay any charges that are subject to a good faith dispute by the Owner. Amounts subject to a good faith dispute shall not bear interest. The withholding of disputed charges shall not be considered a basis for monetary or other default or grounds for termination by Contractor.
   2. Section 9.1.9. Construction Loan Disbursement Agreement.

END OF SECTION

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SECTION 00 72 00
GENERAL CONDITIONS

FORM OF GENERAL CONDITIONS

INCLUDED AS PART OF THE CONTRACT BY REFERENCE.

GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION

American Institute of Architects -AIA Form A201-2017

STANDARD AMERICAN INSTITUTE OF ARCHITECT'S FORMS TO BE INCLUDED BY REFERENCE.

THE FOLLOWING STANDARD FORMS PRODUCED BY THE AMERICAN INSTITUTE OF ARCHITES ARE A PART OF THESE BID DOCUMENTS AND WILL BE INCLUDED AS PART OF THE SIGNED CONTRACT.

NOTE: THIS FORM IS THE 2017 EDITION

GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION

AMERICAN INSTITUTE OF ARCHITECTS - AIA FORM A201

THIS FORM CAN BE PURCHASED FROM THE AMERICAN INSTITUTE OF ARCHITECT'S STATE OFFICE AT COST.

AMERICAN INSTITUTE OF ARCHITECTS

AIA WISCONSIN

RELATED REQUIREMENTS

2.01 SECTION 01 42 16 - DEFINITIONS.

SUPPLEMENTARY CONDITIONS

3.01 REFER TO DOCUMENT 00 73 00 - SUPPLEMENTARY CONDITIONS FOR AMENDMENTS TO THESE GENERAL CONDITIONS.

END OF SECTION

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SECTION 00 72 10
SUPPLEMENTARY CONDITIONS

PART 1 GENERAL

1.01 SUMMARY

A. These Supplementary Conditions amend and supplement the General Conditions defined in Document 00 72 00 - General Conditions and other provisions of the Contract Documents as indicated below. Provisions that are not so amended or supplemented remain in full force and effect.

B. The terms used in these Supplementary Conditions that are defined in the General Conditions have the meanings assigned to them in the General Conditions.

1.02 RELATED SECTIONS

A. Section 00 50 00 - Contracting Forms and Supplements.

B. Section 00 72 00 - General Conditions of the Contract, AIA Document A201-2017 by reference.

C. Section 01 42 16 - Definitions.

1.03 MODIFICATIONS TO GENERAL CONDITIONS

A. Article 1: General Provisions
   1. Change Paragraph 1.1 as follows:
      a. 1.1.1 The Contract Documents
         1) Delete the last sentence of Paragraph 1.1.1 and replace with the following:
            (a) The Contract Documents also include the bidding requirements (Notice to Bidders and Instruction to Bidders). Unless specifically enumerated in the agreements, the Contract Documents do not include sample forms and the Contractor's Bid Form. The Contract Documents executed or identified in accordance with Subparagraph 1.5.1 shall prevail in case of an inconsistency with subsequent versions made through manipulatable electronic operations involving computers.
      b. 1.1.2 The Contract
         1) Create subparagraph 1.1.2.1
            (a) The Contract Documents shall be signed by the Owner and Contractor. If either the Owner or Contractor or both do not sign all the Contract Documents, the Architect shall identify such unsigned Documents. No Contract shall be formed between parties until all Contract Documents are executed by both parties.
      c. Modify the second sentence in Section 1.1.8 to read as follows:
         1) "The Initial Decision Maker shall not be liable for results of interpretations or decisions rendered in good faith."
      d. Add Section 1.1.9:
         1) Terms: The terms indicated below shall be defined as having the meanings assigned to them as follows:
            (a) .1 Products: Means new material, machinery, components, equipment, fixtures, and systems forming the Work, but does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work. Products may also include existing materials or components required for reuse.
            (b) .2 Furnish: To supply and deliver, unload, inspect for damage.
            (c) .3 Install: To unpack, assemble, erect, apply, place, finish, cure, protect, clean, and make ready for use.
            (d) .4 Provide: To furnish and install.
            (e) .5 Substitute the word "Architect/Engineer" for "Architect" each time the latter word appears.
   2. Add the following sentences to the end of Section 1.2.1:

a. In the case of an inconsistency between Drawings and Specifications, or within either Document itself, not clarified by Addendum, the better quality or greater quantity of Work shall be provided in accordance with the Architect's interpretation. In any case of discrepancy, the facts are to be brought to the attention of the Architect for a decision or interpretation.

3. Add Section 1.2.4
   a. Sections of Division 1 - General Requirements govern the execution of the Work of all sections of the specifications.
4. Add Section 1.2.5
   a. 1.2.5 Concurrence of the Contract by the Agency is required before it is effective.
5. Add Paragraph 1.4.1 to Paragraph 1.4:
   a. 1.4.1 In the event of conflict among the various provisions of the Contract Documents, the terms shall be interpreted in the following order of propriety:
      1) Modifications to the Contract
      2) The Contract
      3) Special Conditions
      4) General Conditions
      5) Drawings & Specifications
6. Section 1.5 Ownership and Use of Drawings, Specifications, and Other Instruments of Service
   a. Delete Section 1.5.1 and substitute the following:
      1) Design Documents or other Instruments of Service are Architect's / Engineer's exclusive property. Architect/Engineer retains all common law, statutory and other reserved rights in the Design Documents or other Instruments of Service, including all copyrights in and to Design Documents and other Instruments of Service. Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers shall not own or claim copyright in Design Documents or other Instruments of Service. Submittal or distribution to meet official regulatory requirements, or for other purposes in connection with Project are not to be construed as publication in derogation of Architect's / Engineer's reserved rights.
7. Modify Section 1.6.1 by replacing the words "to whom the notice is addressed" with the words "listed in the Contract".
8. Modify Section 1.6.2 by replacing the words "to whom the notice is addressed" with the words "listed in the Contract".
9. 1.7 Digital Data Use and Transmission
   a. Delete Section 1.7.1 and substitute the following:
      1) The Architect/Engineer may, with the concurrence of the Owner, furnish to the Contractor versions of Instruments of Service in electronic form. The Contract Documents executed or identified in accordance with Subparagraph 1.5.1 shall prevail in case of an inconsistency with subsequent versions made through manipulatable electronic operations involving computers.

B. Article 2: Owner
   1. Delete Sections 2.1.2 and 2.2.
   2. 2.3 Information and Services Required Of The Owner
      a. Modify Section 2.3.3 to read as follows:
         1) If the employment of the Architect terminates, the Owner shall employ a successor whose status under the Contract Documents shall be that of the Architect.
      b. Add the following language to the end of Paragraph 2.3.4:
         1) The Contractor shall compare information furnished by the Owner (including surveys and soil tests with observable physical conditions) and the Contract Documents and on the basis of such review, shall report to the Owner and Architect any conflicts, errors or omissions. Contractor shall be responsible for any additional costs, delays and damages resulting from the Contractor's failure

to immediately report any such errors, inconsistencies or omissions.

3. Change Paragraph 2.5 by deleting the current language and replacing with the following:
   a. Create subparagraph 2.5.1
      1) If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents, and fails within a seven (7) day period, or such shorter time period as may be reasonable under circumstances, after receipt of written notice from the Owner to the Contractor, to commence and continue correction of such default or neglect with diligence and promptness, the Owner may notify the Surety and request it to assume the obligations of the Contractor within seven (7) days following receipt by Contractor and Surety of written notice or the Owner may, without prejudice to any other remedies the Owner may have, correct such deficiencies. In such case an appropriate Change Order or Construction Change Directive shall be issued deducting from the payments then or thereafter due the Contractor, the cost of correction of such deficiencies, including reasonable attorney's fees and compensation for the Architect/Engineer's additional services incurred as result of such default, neglect or failure. Such action by Owner, and amounts charged to the Contractor are both subject to prior concurrence with Architect/Engineer. If current or future payments thereafter due Contractor are not sufficient to cover such amounts, Contractor, or Surety, shall pay difference to Owner.

C. Article 3: Contractor
   1. Add the following at the end of Paragraph 3.1.1:
      a. Contractor shall at request of Owner prior to execution of Agreement and promptly from time to time as requested by the Owner, thereafter furnish Owner an update and current financial statement and/or Contractor Qualification Statement on AIA Document A305.
   2. Add Sub-paragraph 3.1.2.1 as follows:
      a. 3.1.2.1 The Contractor shall supervise and direct Work in excellent and workmanlike manner, complete the work and everything properly incidental thereto as stated in the Project Manual and Drawings or reasonably implied therefrom and otherwise in accordance with Contract Documents. In no case shall the Contractor proceed with any portion of the Work in any uncertainty.
   3. Add at the end of Paragraph 3.1.3 as follows:
      a. The Contractor shall not be relieved of its obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor. To the extent permitted by law, the Contractor waives any rights, claims, or causes of action against Owner as a result of activities or duties or intentional or negligent misconduct by the Architect in the Architect's administration of the Contract, or representations made by Architect/Engineer in Instruments of Service.
   4. 3.2 Review Of Contract Documents and Field Conditions By Contractor
      a. Add the following new language to the end of Paragraph 3.2.1:
         1) The Contractor also represents that all Contract Documents for the Project have been examined; including those intended for work of trades not normally performed by the Contractor's own forces, and that it has become thoroughly familiar with all conditions which may pertain to or affect the Work under the Contract.
      b. Add the following language to Paragraph 3.2.2.:
         1) Modify Section 3.2.2 to add the words:
            (a) including any ordering of materials' in line two after the word "Work".
         2) Any costs associated with Contractor's failure to immediately notify the Architect and the Owner of items listed above shall be borne by the Contractor.
      c. Add to the end of Section 3.2.3 the following:

1) 3.2.3 The Contractor must take field measurements and verify Site conditions, and must carefully compare such field measurements and Site conditions and other information known to the Contractor with the Contract Documents, before ordering any material or doing any Work at the Site.

d. Delete Section 3.2.4 and substitute the following:
   1) Contractor shall make frequent inspections during progress of Work to confirm that Work previously performed by Contractor is in compliance with Contract Documents and applicable laws and regulations bearing on performance of Work and Referenced Standards and that portion of Work previously performed by Contractor or by others are in proper condition to receive subsequent Work.

e. Add the following Paragraphs 3.2.5 - 3.2.8 to Section3.2:
   1) 3.2.5 If the Contractor believes that any portions of the Contract Documents do not comply with applicable laws, statutes, ordinances, building codes, and rules and regulations, or any orders by code enforcement officials or the Owner or its designee acting in the capacity of building code inspectors or Referenced Standards, the Contractor must promptly notify the Owner and the Architect of the non-compliance as provided in Section 3.2.6 and request direction before proceeding with the affected Work.
   2) 3.2.6 Contractor shall promptly notify Owner and Architect/Engineer in writing of any apparent errors, inconsistencies, omission, ambiguities, construction impracticalities or code violations discovered as result of Contractor's review of Contract Documents including any differences between actual and indicated dimensions, locations and descriptions, and shall give Owner and Architect/ Engineer timely notice in writing of same and any corrections, clarifications, additional Drawings or Specifications, or other information required to define Work in greater detail or to permit proper progress of Work. Contractor shall provide similar notice with respect to any variance between its review of Site and physical data and Site conditions observed.
   3) 3.2.7 If Contractor performs any Work involving an apparent error, inconsistency, ambiguity, construction impracticality, omission or code violation in Contact Documents of which Contractor is aware, or which could reasonably have been discovered by review required by Section 3.2, without promptly written notice to Owner and Architect/Engineer and request for correction, clarification or additional information, as appropriate, Contractor does so at its own risk and expense and all claims relating thereafter are specifically waived.
   4) 3.2.8 The Owner is entitled to reimbursement from the Contractor for amounts paid to the Architect/Engineer for evaluating and responding to the Contractor=s requests for information that are not prepared in accordance with the Contract Documents or where the requested information is available to the Contractor from a careful study and comparison of the Contract Documents, field conditions, or other Owner-provided information, Contractor-prepared coordination drawings, or prior Project correspondence or documentation.

5. Change Section 3.3.1 to add the word "written" between the words "timely" and "notice" in line 7.
6. Add Section 3.3.4 as follows:
   a. The Contractor acknowledges that it is Contractor's responsibility to hire all personnel for the proper and diligent prosecution of the Work and the Contractor shall use its best efforts to maintain labor peace for the duration of the Project. In the event of a labor dispute, the Contractor shall not be entitled to any increase in the Contract Sum.
7. Change Paragraph 3.4.1 to read as follows:
   a. 3.4: Labor and Materials
      1) Add the following new language to the end of Paragraph 3.4.1:
      2) Work required by the Contract Documents to be performed after working hours or work the Contractor elects to perform after hours shall be completed at no

additional cost to the Owner.

8. Add Section 3.4.2 as follows:
   a. Except in the case of minor changes in the Work approved by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.
   b. Add Sections 3.4.2.1, 3.4.2.2 and 3.4.2.3 to Section 3.4.2:
      1) 3.4.2.1 After the Contract has been executed, the Architect, Owner, and Contractor shall function as a team to evaluate, review and consider substitution of products in place of those specified under the conditions set forth by the Architect.
      2) 3.4.2.2 After the Contract has been executed, the Owner and Architect/ Engineer may consider requests for the substitution of products in place of those specified. The Owner and Architect/Engineer may, but are not obligated to, consider only those substitution requests that are in full compliance with the conditions set forth in the General Requirements (Division 1 of the Specifications). By making requests for substitutions, the Contractor:
         (a) .1 represents that it has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified;
         (b) .2 represents that it will provide the same warranty for the substitution as it would have provided for the product specified;
         (c) .3 certifies that the cost data presented is complete and includes all related costs for the substituted product and for Work that must be changed as a result of the substitution, except for the Architect/ Engineer=s redesign costs, and waives all claims for additional costs related to the substitution that subsequently become apparent; and
         (d) .4 Agrees that it shall, if the substitution is approved, coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be complete in all respects.
      3) 3.4.2.3 The Owner shall be entitled to reimbursement from the Contractor for amounts paid to the Architect/Engineer for reviewing the Contractor's proposed substitutions and making agreed-upon changes in the Drawings and Specifications resulting from such substitutions.
9. Add the following to the end of Section 3.4.3:
   a. Persons permitted to perform Work under Contractor or any Subcontractor or Sub-Subcontractor shall meet all employment eligibility, safety training, security or drug/alcohol testing requirements required by law or by Owner. Any person not complying with all such requirements shall be immediately removed from the site.
   b. Add Section 3.4.3.1 to Section 3.4.3:
      1) The Contractor or its Subcontractors shall not be owned, operated, or managed by a registered sex offender who has been convicted of a sex offense against a minor. In addition, the Contractor or their Subcontractors shall not permit an employee who is a registered sex offender convicted of a sex offense against a minor on real property of the Owner / Library . The Contractor and its Subcontractors shall further acknowledge and certify services provided under this Contract comply with the above requirments, and shall fully execute and deliver copies of Acknowledgment and Certification to the Owner / Library prior to execution of Agreement.
10. Strike existing Paragraph 3.5.1 and replace with the following:
    a. 3.5.1 Contractor shall warrant to Owner that materials and equipment furnished under Contract will be of good quality and new unless otherwise required or permitted by Contract Documents, that workmanship will be free from defects not inherent in quality required or permitted, that workmanship will comply with all applicable laws,

building codes, rules and regulations, and that workmanship will conform to requirements of Contract Documents.

11. Add the following Paragraphs to 3.5:
    a. 3.5.3 The Contractor's general warranty and any additional or special warranties are not limited by the Contractor's obligations to specifically correct defective or nonconforming Work as provided in Article 12, or are they limited by any other remedies provided in the Contract Documents. The Contractor shall also be liable for any damage to property or persons (including death) including consequential and direct damages relating to any breach of the Contractor's general warranty or any additional or special warranties required by the Contract Documents.
    b. 3.5.4 The Contractor shall furnish all special warranties required by the Contract Documents to the Owner no later than Substantial Completion. The Owner may require additional special warranties in connection with the approval of "Or-Equals" or Substitutions, Allowance items, Work that is defective or nonconforming, or the acceptance of nonconforming Work pursuant to Article 12.
    c. 3.5.5 In case of work performed by Subcontractors and where warranties are required, secure warranties from said Subcontractors addressed to and in favor of the Owner. Deliver copies of same to Architect upon completion of work. Delivery of said warranties shall not relieve the Contractor from any obligations assumed under any other provision of contract.
12. Delete Section 3.6 text and add Sections 3.6.1 through 3.6.7 to Section 3.6:
    a. 3.6.1 Wisconsin Use Taxes shall be paid on all supplies and materials used in, and made component parts of, the Project.
    b. 3.6.2 Wisconsin Sales Taxes shall not be paid on qualified building materials purchased, or withdrawn from inventory, which will be incorporated into real property for Project.
    c. 3.6.3 The Owner is a designated tax exempt entity and will distribute Tax Exemption Certificates and Authorization Letters to the Contractor and all Subcontractors who have been identified at, or before filing of the Performance Bond.
    d. 3.6.4 At or before the time the Performance Bond is filed, Contractor shall provide a listing to the Owner identifying all Subcontractors. Listing shall indicate company name, address, telephone number, fax number, contact name, and Employer ID # for Contractor and each Subcontractor. Contractor and Subcontractors shall make copies of the Tax Exemption Certificate and provide to each supplier providing construction material, a copy of the Tax Exemption Certificate. This Certificate will allow the Contractor and Subcontractors to purchase qualified building materials free from sales tax for the Project. The Tax Exemption Certificate and Authorization Letter have been developed exclusively for this purpose and are applicable only for the specific Project under this Contract.
    e. 3.6.5 Contractor shall be responsible for informing themselves of tax laws, requirements, regulations, and interpretations as they apply to this Project.
    f. 3.6.6 Contractor shall maintain all records, invoices, receipts, or other accounting data regarding material purchases and shall allow, upon written request of Owner, and within reasonable time frame after receipt of such request, Owner to audit such records to verify tax savings. If audit reveals taxes paid or savings not transferred to Owner, Contractor shall be liable to Owner for those amounts and Owner may back charge Contractor for those amounts if balance of funds due and payable remains at time of such discovery.
        1) .1 Contractor shall require all Subcontractors of any tier to maintain all records, invoices, receipts, or other account data regarding material purchases. Contractor shall collect such records with each application for payment if receives from its Subcontractors and shall maintain such records in same manner and location as Contractor's records.
        2) .2 Contractor shall ensure its Subcontractors and any lower-tier Subcontractors including these obligations in their contracts and bind themselves in same

manner as Contractor is bound to Owner.

13. Change Section 3.7 as follows:
    a. Delete Section 3.7.1 and substitute the following:
        1) 3.7.1 Unless otherwise specified in the Contract Documents, the Contractor shall secure and pay for the building permit and other permits and governmental fees, licenses, and inspections, including storm water permits, necessary for proper execution and completion of the Work which are legally required when bids are received or negotiations concluded.
        2) If applicable, Contractor shall file Notice of Intent for NPDES Coverage Under General Permit, file and implement Storm Water Pollution Prevention Plan (SWPPP), maintain pollution prevention devices, and file Notice of Discontinuation upon stabilization of site for storm water run-off associated with Project. Contractor shall also pay for governmental inspection fees associated with Storm Water Pollution Prevention Plan.
    b. Delete Paragraph 3.7.3 and replace as follows:
        1) 3.7.3 If the Contractor, or any of its Subcontractors, performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.ity for such Work and shall bear the costs attributable to correction.
    c. Modify Section 3.7.4 as follows:
        1) Add the words “, in writing,” in line 11 after the word “Contractor.”
        2) Add the following before the last line: “Failure to properly register a claim within the 21 day period shall be grounds for denial of the claim.”
    d. Modify subparagraph 3.7.5 to read as follows:
        1) Add the words “knowingly” and “and recognizes” on each side of the word “encounters” in the first sentence and add the words “or good faith belief of such existence” between the words “existence” and “of” in the last sentence.
    e. Add the following new Paragraph 3.7.6:
        1) The Contractor is responsible for scheduling inspections related to the performance of its Work and ensuring Work is complete for inspections. Any costs associated with reinspections caused by irregularities, deficiencies or non-conforming Work will be borne by the responsible contractor including all Architectural and Engineering Services related to evaluation of the problem and development of an acceptable solution.
    f. Add the following new Paragraph 3.7.7:
        1) The Contractor shall take note and comply with all governing laws, rules, and regulations affecting the Work. This may include, but is not limited to, such laws, rules, and regulations as:
            (a) .1 Licensing of Contractors for special requirements, eg hazardous waste removal.
            (b) .2 Requirements for special construction permits.
            (c) .3 Exemption from sales tax, if applicable.
            (d) .4 Employment requirements when required by law or by Owner.
            (e) .5 Local labor requirements.
            (f) .6 Non-discriminatory hiring practices.
    g. Add the following new Paragraph 3.7.8:
        1) State of Wisconsin, its agencies, and its political subdivisions, including cities, school districts and public utilities are required by Code to require reciprocal resident bidder and resident labor force preference.
        2) Add the following new Paragraph 3.7.8.1:
            (a) Resident Bidder: means person or entity authorized to transact business in State of Wisconsin and having place of business for transacting business with state at which it is conducting and has conducted business for at least

three (3) years prior to date of first advertisement for public improvement. If another state or foreign country has more stringent definition of Resident Bidder, more stringent definition shall be applicable as to bidders from that state or foreign country.

3) Add the following new Paragraph 3.7.8.2:
   (a) Resident Bidder shall be allowed preference against nonresident bidder from state or foreign country other than Wisconsin if that state or foreign country gives or requires any preference to bidders from that state or foreign country, including, but not limited to, any preference to bidders, the imposition of any type of force preference, or any other form of preferential treatment to bidders or laborers from state or foreign country. Preference allowed shall be equal to preference given or required by state of foreign country in which nonresident bidder is resident.
4) Add the following new Paragraph 3.7.8.3:
   (a) If Contractor is nonresident bidder Contractor is required to specify in Agreement between Owner and Contractor, whether any preference is in effect in nonresident bidder's state or country at time of this bid and identify source of regulations.

14. Change Paragraph 3.9 to read as follows:
    a. Delete subparagraph 3.9.1 and replace with the following:
       1) The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site at all times during performance of the Work, including work of the Contractor's subcontractors. Any change in superintendent personnel must be approved by the Owner. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor. Other communications shall be similarly confirmed on written request in each case. This individual shall be fluent in all languages necessary to communicate with Contractor's employees. Owner shall be furnished with the e-mail address and cell phone numbers for the Superintendent. The approved superintendent will work in this position until completion of the Work unless the superintendent shall no longer be in the Contractor’s employ, or shall be released at the request of the Architect and/or Owner.
    b. Delete subparagraph 3.9.2 and replace with the following:
       1) The Contractor shall, within three (3) business days of the Owner's notification of an intent to award the Contract, submit to the Owner, and Architect/Engineer, the name and qualifications of the proposed superintendent(s) for review and approval. Within fourteen (14) days of receipt of the information, the Architect shall notify the Contractor whether the Owner or Architect has reasonable objection to the proposed superintendent. When the superintendent(s) are approved, they shall not be removed without the Owner's written approval which will not be unreasonable withheld. The responsibility of the superintendent is to supervise, schedule, coordinate, and manage field operations.
    c. Add subparagraph 3.9.3.1 as follows:
       1) The Superintendent or Superintendents shall be thoroughly competent with full experience in all phases of the Work to be performed under this Contract. Anyone not deemed capable of directing all trades involved in the Work shall be replaced or supplemented immediately upon request, by someone who is satisfactory. After a satisfactory superintendent has been assigned, they shall not be withdrawn without the consent of the Architect and/or Owner.
15. Change Paragraph 3.10 as follows:
    a. 3.10: Contractor’s Construction Schedules
       1) Delete Sections 3.10.1 and 3.10.2 and substitute the following:
          (a) Section 3.10.1:

(1) The Contractor, within ten (10) days of award of Contract, shall prepare and submit in its native electronic and graphic format, Owner's and Architect/ Engineer's approval Contractor's baseline construction schedule for Work. Schedule shall not exceed time limits current under Contract Documents, shall be revised at appropriate intervals as required by conditions of Work and Project, shall be related to entire Project to extent required by Contract Documents, or as requested by Owner or Architect/Engineer, and shall provide for expeditious and practicable execution of Work. Schedule at minimum shall demonstrate rate of work (ROW), availability dates, permits, submittals, working drawings, procurement, fabrication, delivery of materials, construction, and other activities necessary to complete Work. Thereafter, Contractor shall prepared and update construction schedule on at least a monthly basis a current Construction Schedule, if not more frequently at Owner's or Architect's request, to be submitted to Owner in graphic and native electronic format with each Application for Payment. Each update shall include narrative including:
(2) .1 Description of status of schedule.
(3) .2 Discussion of current and anticipated delays.
(4) .3 Discussion of progress of critical path activities.
(5) .4 Discussion of critical path for remainder of project.
(6) .5 Listing and discussion of logic changes and duration changes.

(b) Section 3.10.2:
(1) Contractor shall prepare submittal schedule within fourteen (14) days after being awarded Contract and thereafter as necessary to maintain current submittal schedule. The Contractor shall submit schedule(s) for Architect/Engineer's approval. Architect/Engineer's approval shall not unreasonably be delayed or withheld. If the Contractor fails to submit a submittal schedule, or fails to provide submittals in accordance with the approved submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals. Submittal schedule shall:
(2) .1 be coordinated with Contractor's construction schedule, and;
(3) .2 allow Architect/Engineer reasonable time to review submittals.

2) Add subparagraph 3.10.4 as follows:
(a) The Contractor shall furnish information concerning the Work. This information will include, but not be limited to the following:
(1) Daily: Manpower by craft.
(2) Weekly: Two week look ahead schedule update. Delivery requirements and status of materials.
(3) Monthly: Written report including schedule update as outlined above and cost information.

16. Delete Section 3.11 text and substitute the following:
a. Contractor shall maintain at site for Owner one copy of Drawings, Specifications, Addenda, Current Construction Schedule, Change Orders and other Modifications, in good order and marked currently to indicate field and similar required submittals. Contractor shall display current Construction Schedule at site for reference and reliance by Owner and Architect/Engineer. These shall be available to Architect/Engineer and shall be delivered to Architect/Engineer for submittal to Owner upon completion of Work as record of Work as constructed.

17. Change Paragraph 3.12 as follows:
a. Add the following to the end of Paragraph 3.12.5: "The Contractor shall provide the Owner and the Architect with copies of all submittals made to regulatory agencies.
b. Add the following at end of Section 3.12.7:

1) Contractor shall correct at their cost, and without any adjustment in Contract time, any Work the correction of which is required due to Contractor's failure to obtain approval of submittal required to have been obtained prior to proceeding with Work, including, but not limited to, correction of any conflicts in Work resulting from such failure.

c. Delete subparagraph 3.12.8 and replace with the following:
   1) The Work shall be in accordance with reviewed submittals except that the Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Architect's review of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the Architect in writing of such deviation at the time of submittal and (1) the Architect has taken appropriate action relative to the specific deviation as a minor change in the work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omission in Shop Drawings, Product Data, Samples or similar submittals by the Architect's review thereof.

d. Modify Section 3.12.10.1 by adding the word “reasonably” before the word “rely” in line 4.

e. Add Section 3.12.11 to Section 3.12:
   1) The Architect/Engineer’s and Consultant’s review of Contractor’s submittals will be limited to examination of an initial submittal and 1 resubmittal. Architect will notify the Contractor before beginning a further review that such review will result in additional cost to the Owner which can be charged back to Contractor. The Contractor shall reimburse the Owner for amounts paid to the Architect/Engineer for evaluation of additional resubmittals.

18. Change Paragraph 3.13 to read as follows:
    a. 3.13: Use Of Site
       1) Add the following new Paragraph 3.13.2:
          (a) Contractor shall perform the Work so as to cause a minimum of inconvenience to and interruption of the Owner’s operations. Any and all interruptions of the operations of the Owner necessary for the performance of the Work shall be noted in the progress schedule and the Contractor shall additionally give the Owner sufficient advance notice of such interruption as to allow the Owner to adjust operations accordingly. Contractor’s failure to give the Owner timely notice of such intentions shall place the responsibility of any resulting delays or additional costs solely with the Contractor.
       2) Add the following new Paragraph 3.13.3:
          (a) Except as may be specifically provided in the Contract Documents, the Contractor shall provide all necessary temporary facilities, including power, water, sanitation, scaffolding, storage, and security. If Owner makes any such facilities available to Contractor, it is without representation or warranty as to their adequacy for Contractor’s use, and Contractor shall indemnify, defend, and hold Owner harmless from and against any claims arising out of Contractor’s use of such facilities.
       3) Add the following new Paragraph 3.13.4:
          (a) The Contractor shall not bring or permit any subcontractor, supplier or anyone else for whom the Contractor is responsible, to bring on the site any asbestos, PCB’s petroleum, hazardous waste or radioactive materials (except for proper use in performing the Work)

19. Strike Paragraph 3.15.1 and 3.15.2 and replace with the following:
    a. 3.15 CLEANING UP, WORKING HOURS AND NOISE ORDINANCE
       1) 3.15.1 Work will be performed in accordance with the Contract Documents, the Applicable Building Code, and other applicable law governing the Contractor’s performance of the Work. No delays resulting from compliance with applicable

laws or regulations may form the basis for any claim by the Contractor for delay damages or additional compensation or for any extensions of the Contract Time. The Contractor must not permit work outside of hours established in the Contract Documents on a Saturday, Sunday or State or federal holiday without the written consent of the Owner, given after prior written notice to the Architect and any other applicable consultants; such consent, if given, may be conditioned upon payment by the Contractor of the Owner's, Architect's and any other applicable consultants' additional costs and fees, testing or regulatory agency costs incurred in monitoring such off-hours Work. The Contractor must notify the Owner as soon as possible if Work must be performed outside such times in the interest of the safety and protection of persons or property at the Site or adjacent thereto, or in the event of an emergency. In no event shall the Contractor permit Work to be performed at the Site without the presence of the Contractor's superintendent and person responsible for the protection of persons and property at the Site and compliance with all applicable laws and regulations, if different from the superintendent.

2) 3.15.2 The Contractor must comply with any applicable Noise Ordinances and any successor or substitute provisions covering the regulation of noise levels. It is the duty of the Contractor to familiarize itself with those provisions and perform the Work in compliance with those provisions.

3) 3.15.3 The Contractor must keep the Site and adjacent areas free from accumulation of waste materials or rubbish caused by operations under the Contract, and must keep tools, construction equipment, machinery and surplus materials suitably stored when not in use. If the Contractor fails to do so in a manner reasonably satisfactory to the Owner or the Architect within forty-eight (48) hours after notice or as otherwise required by the Contract Documents, the Owner may clean the Site and back charge the Contractor for all costs associated with the cleaning. The Contractor shall keep the premises and surrounding area free from accumulation of waste materials or rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery and surplus materials from and about the Project.

20. Change Paragraph 3.18 to read as follows:

a. 3.18 Indemnification

1) Delete 3.18.1 in its entirety and replace with the following:

(a) 3.18.1 To the fullest extent permitted by law, the Contractor shall defend, indemnify and hold harmless the Owner, and its agents, representatives, employees, and consultants from and against all claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from or in connection with the performance of the Work, provided that any such claim, damages, loss, or expense is caused in whole or in part by any negligent act or omission of the Contractor, anyone directly or indirectly employed by it or anyone for whose acts it may be liable, regardless of whether or not it is caused in part by the negligence or fault of a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or otherwise reduce any other right or obligation of indemnity what would otherwise exist as to any party or person described in the Agreement.

2) Delete 3.18.2 in its entirety and replace with the following:

(a) 3.18.2 In any and all claims, damages, losses and expenses against the Owner or any of its agents, representatives, employees, and consultants by any employee of the Contractor, or anyone directly or indirectly employed by any of them or anyone for whose acts it may be liable, the indemnification obligation under this Section shall not be limited in any way by any limitations on the amount or types of damages, compensation or

benefits payable by or for the Contractor under the workers' or workmen's compensation acts, disability benefit acts, or other employee benefit acts.

b. Add the following subparagraphs to 3.18;
   1) 3.18.3 "Claims, damages, losses, and expenses" as these words are used in this agreement shall include actions, causes of action, liabilities, suits, judgments, settlements, attorneys' fees," claims, damages, losses, or expenses of any sort whatsoever and shall also include, but not be limited to (1) injury or damage consequent upon the failure of or use or misuses by Contractor, its Subcontractors, agents, servants, or employees, of any kind of equipment, whether or not the same be owned, furnished, or loaned by Owner; (2) all attorneys fees and costs incurred in bringing an action to enforce the provisions of this indemnity or any other indemnity contained in the General Conditions, as modified by the Supplementary General Conditions; and (3) time expended by the parties being indemnified and employees, at their usual rates plus cost of travel, long distance telephone, and reproduction of documents.
   2) 3.18.4 Contractor's indemnity obligations under this Paragraph 3.18 shall also specifically include, without limitation, all fines, penalties, damages, liability, costs, expenses (including, without limitation, reasonable attorneys' fees), and punitive damages (if any) arising out of, or in connection with, any (i) violation of or failure to comply with any law, statute, ordinance, rule, regulation, code, or requirement of a public authority that bears upon the performance of the Work by Contractor, Subcontractors, or any person or entity for whom either is responsible, (ii) means, methods, procedures, techniques, or sequences of execution or performance of the Work, and (iii) failure to secure and pay for permits, fees, approvals, licenses, and inspections as required under the Contract Documents, or any violation of any permit or other approval of a public authority applicable to the Work, by Contractor, Subcontractors, or any person or entity for whom either is responsible, but only to the extent caused by the negligent acts or omissions of Contractor, Design Consultants, Subcontractor, or any person or entity for whom either is responsible.
   3) 3.18.5 In the event the Owner should prevail in any legal action arising out of the performance or non-performance of this Agreement, the Contractor shall pay, in addition to any damages, all expenses of such action including reasonable attorney's fees, all expert witness fees, costs, and litigation expenses incurred by the Owner, including those incurred on appeal. The term "legal action" shall be deemed to include any arbitration, administrative proceedings, and all actions at law or in equity, including appeals.

21. Article 4: Administration Of The Contract
   a. Delete Section 4.1.1 and substitute the following:
      1) The "Architect" is defined in this Contract as the Engineer or Architect lawfully licensed by the State to practice architecture or engineering or an entity, licensed by the State to lawfully practice architecture or engineering identified as such in this Contract and as is referred to throughout the Contract documents as if singular in number. The term "Engineer," "Architect/Engineer," "Engineer/Architect," "Architect's authorized representative," "Engineer's authorized representative," or "Architect/Engineer's authorized representative" shall mean "Architect" as defined in this paragraph.
   b. Delete Paragraph 4.2.2. and replace with the following:
      1) The Architect, as a representative of the Owner, shall attend construction meetings and visit the site while Work is in progress not less often than as outlined in the Contract between Owner and Architect, or as otherwise mutually agreed to by the parties, to observe and evaluate the site and the Work; to become familiar with the progress and quality of the Work; and to determine whether the Work evaluated and observed is proceeding in accordance with the Contract Documents and construction schedule and whether there are defects

or deficiencies in the Work evaluated and observed. On the basis of on-site observations and evaluations, the Architect shall keep the Owner reasonably informed of the progress and quality of the Work and its conformance with the Construction Documents and the construction schedule. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for, the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents, except as provided in Section 3.3.1.

c. Add Section 4.2.2.1 to Section 4.2.2:
   1) The Owner is entitled to reimbursement from the Contractor for amounts paid to the Architect/Engineer for site visits made necessary by the fault of the Contractor or by defects and deficiencies of the Work.

d. Delete Section 4.2.4 and substitute with the following:
   1) Except as otherwise provided in the Contract Documents or when direct communications have been specially authorized, the Owner and Contractor shall include the Architect in communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any relevant direct communications between the Owner and the Contractor otherwise relating to the Project. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.
   2) Add the following subparagraphs:
      (a) 4.2.4.1 All notices, demands, requests, instructions, approvals, proposals and claims must be in writing. Any notice or demand upon the Contractor shall be sufficiently given if delivered at the office of the Contractor stated on the signature page of the agreement (or at such other office as the contractor may from time to time designate in writing to the Owner), or if deposited in the United States mail in a sealed, postage-paid envelope or delivered with charges prepaid to any telegraph company for transportation, in each case addressed to such office.
      (b) 4.2.4.2 All papers required to be delivered to the Owner shall, unless otherwise specified in writing to the Contractor, be delivered to the office of FEH DESIGN, 951 Main Street, Dubuque, IA 52001 and any notice to or demand upon the Owner shall be sufficiently given if so delivered, or if deposited in the United States mail in a sealed, postage prepaid envelope, or delivered with charges prepaid to any telegraph company for transmission to said Owner at such address, or to such other representatives of the Owner may subsequently specify in writing to the Contractor for such purpose.
      (c) 4.2.4.3 Any such notice shall be deemed to have been given as of the time of actual delivery of (in the case of mailing) when the same should have been received in due course of post, or in the case of telegrams, at the time of actual receipt, as the case may be.
   3) Add the following to Section 4.2.7:
      (a) The Architect will review the initial submittal and one (1) re-submittal. If furthre review is required on more than one (1) re-submittal (i.e. second, thurd, or more re-submittal) the Architect will do so on an hourly basis and notify Contractor before begnning the further review that such review will result in additional cost to the Owner which can be charged back to the

Contractor. The Architect will then charge the Owner for this additional service (as provided in the Agreement between the Architect and Owner) and the Owner will then deduct the sum due for those additional services occasioned by excessive re-submittals from the amount due to the Contractor at the next application for payment. In addition, if submittals are provided either incomplete or requiring other submittals in order to conduct an appropriate review, and the Contractor requests review of these "incomplete" submittals, they will be reviewed on an hourly basis as set forth above.

4) Add Section 4.2.7.1 to Section 4.2.7:
   (a) In no case will the Architect/Engineer's review period on any submittal be less than fifteen (15) calendar days after receipt of the submittal from the Contractor.
5) Add Section 4.2.14.1 to Section 4.2.14:
   (a) Contractor's requests for information shall be prepared and submitted in accordance with Division1 General Requirements sections on form acceptable to Architect/Engineer. The Architect/Engineer will return without action requests for information that does not conform to requirements of the Contract Documents.

22. Article 5: Subcontractors
    a. 5.2 Award of Subcontracts and other Contracts for Portions of the Work
       1) Make the following changes to paragraph 5.2.1:
          (a) Replace the words "as soon as practicable" (line 1) with the words "within 10 days".
          (b) Add to the end of paragraph 5.2.1:
             (1) A list of Subcontractors shall be submitted in duplicate on AIA Document G805, 2001 Edition. Contractor shall update this list throughout Project and keep Owner and Architect/Engineer advised of any new subcontractors employed.
       2) 5.2.3 Add the following language to the end of subparagraph:
          (a) Acceptance or rejection of any subcontractor shall not relieve the Contractor of performance of Work as called for under the Contract Documents, nor shall acceptance of a particular subcontractor be construed as acceptance of any particular purpose or material.
       3) Add Paragraph 5.2.5 Manufacturers and Fabricators:
          (a) Add subparagraph 5.2.5.1:
             (1) Not later than thirty (30) days after the date of commencement of the Work, the Contractor shall furnish in writing to the Owner through the Architect/ Engineer the names of persons or entities proposed as manufacturers or fabricators for certain products, equipment and systems identified in the General Requirements (Division 1 of the Specifications) and, where applicable the name of the installing Subcontractor. The Architect/Engineer may reply within fourteen (14) days to the Contractor in writing stating 1) whether the Owner or the Architect/ Engineer has reasonable objection to any such proposed person or entity or 2) that the Architect/Engineer requires additional time to review. Failure of the Owner or Architect/Engineer to reply within the fourteen (14) day period shall constitute notice of no reasonable objection.
          (b) Add subparagraph 5.2.5.2:
             (1) The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect/Engineer has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.
          (c) Add subparagraph 5.2.5.3:

(1) If the Owner or Architect/Engineer has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect/Engineer has no reasonable objection. If the proposed but rejected manufacturer or fabricator was reasonable capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute manufacturer's or fabricator's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

(d) Add subparagraph 5.2.5.4:

(1) The Contractor shall not substitute a person or entity previously selected if the Owner or Architect/Engineer makes reasonable objection to such substitution.

4) 5.4 Contingent Assignment of subcontractors:

(a) Delete Paragraph 5.4.2 in its entirety.

23. Article 6: Construction by Owner or by Separate Contract

a. Add the following to the end of Paragraph 6.1.1:

1) The Contractor shall give notification of the potential of a claim in writing to Owner and/or Separate Contractor within forty-eight (48) hours of the occurrence or discovery of the potential of an occurrence of the delay or action that will result in making a claim.

b. Delete the last sentence of Section 6.2.2 and insert the following to the end of section:

1) , except as to defects not then reasonably discoverable.'

24. Article 7: Changes in the Work

a. Add the following to the end of Paragraph 7.1.1:

1) No claim for an addition to the maximum Contract sum shall be considered a valid claim unless a written change order procedure is followed as outlined in this Section. Verbal authorization for changes must be supported by written approval before being considered valid.

b. Add the following Clauses to 7.1.2:

1) 7.1.2.1 All changes in Material or Methods as described in the Plans and Specifications must have written approval by the Owner and Architect prior to incorporation in the Project.

2) 7.1.2.2 All changes in the Plans and Specifications must be documented by a Change Order Form issued by the Architect & approved by the Owner.

3) 7.1.2.3 Total adjustments in Contract Amount are to reflect a reasonable markup to reflect overhead and profit, not to exceed as follows:

4) 7.1.2.3.1 Change executed by Subcontractor: 10% by Subcontractor for overhead and profit and 5% by General Contractor for coordination and profit. Subcontractor and Sub-subcontractor's total aggregate shall not exceed ten percent (10%) percent of the labor and material cost.

5) 7.1.2.3.2 Change executed by Contractor without subcontractor involvement: 10% for overhead and profit.

6) On Work deleted from the Contract, credit to the Owner shall be the Architect/Engineer approved net cost plus one-half (½) of the overhead and profit percentage noted above.

7) 7.1.2.3.3 Contractor and Sub-contractors shall provide written detailed documentation for each (sub) contractor showing their time and materials on all changes submitted for review by the Architect unless pre-approved at a fixed amount. In order to facilitate checking of quotations for extras or credits, all proposals, except those so minor that their propriety can be seen by inspection,

shall be accompanied by a complete itemization of costs including labor, materials and Subcontracts. Labor and materials shall be itemized in the manner described above. Where major cost items are Subcontracts, they shall be itemized also. In no case will a change involving over $500.00 be approved without such itemization.

c. Add the following subparagraph 7.2.2:
   1) 7.2.2 The forms used to process a Change Order will include AIA Document G701, Change Order
d. Add the following subparagraph 7.2.3:
   1) Contractor shall submit change proposals covering contemplated Change Order within ten (10) days after request of Owner, or Architect/Engineer or within ten (10) days after event giving rise to Contractor's claim for change in Contract Sum or Contract Time. No increase in Contract Sum or extension of Contract Time will be allowed Contractor for cost or time involved in making change proposals. Change proposals shall define or confirm in detail Work which is proposed to be added, deleted, or changes and shall include any adjustment which Contractor believes to be necessary in (i) Contract Sum, (ii) Contract time. Any proposed adjustment shall include detailed documentation including, but not limited to; cost, properly itemized and supported by sufficient substantiating data to permit evaluation including cost of labor, materials, supplies and equipment, rental cost of machinery and equipment, additional bond cost, plus fixed fee for profit and overhead (which includes office overhead and site-specific overhead and general conditions) of ten percent (10%) if Work is performed by Contractor, or five percent (5%) if Work is performed by Subcontractor or Sub-subcontractor. Subcontractors and Sub-subcontractors overhead and profit in turn shall not exceed total aggregate of ten percent (10%). Change proposals shall be binding upon Contractor and may be accepted or rejected by Owner at their discretion. Owner may, at their option, instruct Contractor to proceed with Work involved in change proposal in accordance with this section without accepting change proposal in its entirety.
e. Add the following subparagraph 7.2.4
   1) If the Owner determines that a change proposal is appropriate, the Architect will prepare and submit a request for a Change Order or Contract Amendment providing for an appropriate adjustment in the Contract Sum or Contract Time, or both, for further action by the Owner. No such change is effective until the Owner and Architect sign the Change Order.
f. Add the following to subparagraph 7.3.2:
   1) ,upon prior written approval of the Owner:”

25. Article 8: Time
    a. Add the following new Clause to 8.1.1:
       1) 8.1.1.1 The project shall be substantially complete by 08-28-2026.
       2) Contractor may, at Contractor's option, complete the project at an earlier date to be indicated on the Bid Form. Time is of the essence.
    b. Add the following to the end of 8.1.2:
       1) or the date of the Notice To Proceed, whichever occurs later.”
    c. Add the following paragraphs to 8.2:
       1) Add the following at end of 1st sentence of Section 8.2.2:
          (a) or prior to approval of Certificates of Insurance, and Additional Insured Endorsement and Notice of Cancellation Endorsement required to be submitted to Owner under Contract.
       2) 8.2.3 Add the following to the end of paragraph 8.2.3, “If Contractor’s Work shall fall behind schedule for reasons that are not excused under the terms of the Contract, Contractor shall add additional workers or shifts, and/or work overtime as necessary to maintain the Construction Schedule.”

3) 8.2.4 The Contractor must conform to the most recently approved Construction Schedule. The Contractor must complete the indicated Work or achieve the required percentage of completion, as applicable, within any interim completion dates established in the most recently approved Construction Schedule.
4) 8.2.5 The Contractor must maintain at the Site, available to the Owner and the Architect for their reference during the progress of the Work, a copy of the approved Construction Schedule and any approved revisions thereto. The Contractor must keep current records of and mark on a copy of the approved Construction Schedule the actual commencement date, progress, and completion date of each scheduled activity indicated on the Construction Schedule.
5) 8.2.6 The Contractor represents that its bid includes all costs, overhead and profit which may be incurred throughout the Contract Time and the period between Substantial and final Completion. Accordingly, the Contractor may not make any claim for delay damages based in whole or in part of the premise that the Contractor would have completed the Work prior to the expiration of the Contract time but for any claimed delay.
6) 8.2.7 If the Contractor's progress is not maintained in accordance with the approved Construction Schedule, or the Owner determines that the Contractor is not diligently proceeding with the Work or has evidence reasonably indicating that the Contractor will not be able to conform to the most recently approved Construction Schedule, the Contractor must, promptly and <u>at no additional cost to the Owner</u>, take all measures necessary to accelerate its progress to overcome the delay and ensure that there will be no further delay in the progress of the Work and notify the Owner.
7) 8.2.8 The Owner reserves the right to issue a written directive to accelerate the Work that may be subject to an appropriate adjustment, if any, in the Contract Sum. If the Owner requires an acceleration of the Construction Schedule and no adjustment is made in the Contract Sum, or if the Contractor disagrees with any adjustment made, the Contractor must file a claim as provided in Article 15 or the same will be deemed to be conclusively waived.

d. Change paragraph 8.3.1 as follows:
   1) Delete the words "labor dispute" and add the words "excusable weather delays as defined in Section 15.1.5.2", between the words "fire" and "unusual" in 3rd line of section 8.3.1.

e. Add the following language to the end of Paragraph 8.3.1:
   1) A time extension shall be Contractor's sole remedy and compensation for all such delays other than those resulting from the acts or negligence of the Owner, the Architect, or the Owner's separate contractors (collectively "Owner Caused Delays"). For proven Owner Caused Delays, the Contractor may recoup the actual costs resulting from such delays, but not for any additional profit or fee.

26. Article 9: Payments And Completion
   a. 9.2 Schedule of Values:
      1) Add to Paragraph 9.2 :
         (a) In the 1st sentence, add the words "thirty (30) days" between the words "Architect," and "before."
         (b) Change "the entire" to "ninety-five percent of the" in the second line. Add "and approved" after the word "required" in the second sentence.
   b. 9.3 Application for Payment
      1) Delete Paragraph 9.3.1 and replace as follows:
         (a) 9.3.1 At least thirty (30) days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment for operations completed in accordance with the schedule of values. Such application shall be notarized, if required, and supported by such data substantiating the Contractor's right to payment as

the Owner or Architect may require, such as copies of requisitions from Subcontractors and material suppliers. If the Contract Documents required the Owner to retain a portion of the payments until some future time, the Applications for Payment shall clearly state the percentage and the amount to be retained. Once the Application is approved by the Architect, the Application for Payment must be submitted for approval to the City of Delavan at their next regularly scheduled meeting. The application must be received at the Owner / Library office at least one week prior to the scheduled meeting for it to be included in that meeting's scheduled business. The form of Application for Payment shall be a notarized AIA Document G702, APPLICATION AND CERTIFICATE FOR PAYMENT, supported by AIA Documents G703, CONTINUATION SHEET. Contractor shall furnish forms.

2) Omit Section 9.3.1.1 from supplemental general conditions.
3) Modify Section 9.3.1.2 by inserting the following the word “Payments” in line 1: ‘must be consistent with the approved Schedule of Values and’.
4) Add the following new Clauses to 9.3.1:
   (a) 9.3.1.3 Until Substantial Completion the Owner shall pay 95% of the amount due the Contractor on account of progress payments.
   (b) 9.3.1.4 The Owner's release of retained funds and final payment to the Contractor shall be made in accordance with Wisconsin Code.
   (c) 9.3.1.3 Progress payments shall be made monthly upon application. Monthly estimates will be paid to the Contractor as the work progresses in the amounts equal to ninety-five percent (95%) of the Contract Value of the work completed, including materials and equipment delivered and properly stored at the Project site, during the preceding calendar month, and will be based upon an Application prepared by the Contractor and subject to the approval of the Architect. The Contractor shall submit the Application for Payment to the Architect not later than the first day of the following month. The Owner shall make payment to the Contractor by the last day of the month. Such monthly payments shall in no way be construed as an act of acceptance for any part of the work, partially or totally completed. The remaining balance of five percent (5%) of the Contract Sum, shall be paid by the Owner to the Contractor no earlier than thirty-one (31) days after the date of final acceptance of said Work by the Owner, subject to the conditions and in accordance with the provisions the Code of Wisconsin. No such partial of final payment will be due until the Contractor has certified to the Owner that the materials, labor and services involved in each estimate have been paid for in accordance with the requirements stated in the Specifications.

c. Modify Paragraph 9.5 Decisions to Withhold Certification:
   1) Add the following to the end of Paragraph 9.5.1:
      (a) Service work not attended to.
      (b) Evidence of lack of careful workmanship.
      (c) Unworkmanlike or over expeditious construction.
      (d) Lack of attention to the special field duties specified.
   2) Delete subparagraph 9.5.4 in its entirety.

d. 9.6 Progress Payments
   1) Add the words "following City approval" between the words "payment" and "in" in 1st line of Section 9.6.1.
   2) Add the following language to the end of Paragraph 9.6.1:
      (a) Owner will, within thirty (30) days of presentation to them of Notarized Certificate for Payment, pay Contractor progress payment on basis of approved Application for Payment. Laws of State of Wisconsin shall be followed regarding Contractor Payment, with a five percent (5%) retainage

held from each progress payment. Final payment shall be made no sooner than thirty-one (31) days following final approval and acceptance of completed Project. Until Substantial Completion, the Owner will pay ninety-five percent (95%) of the amount due the Contractor on account of Progress Payments, (5%) retainage.

3) Delete Paragraph 9.6.4 and substitute the following:
   (a) The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and material and equipment suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven (7) days, the Owner shall have the right to contact Subcontractors to ascertain whether they have been properly paid. Regardless of any requests made pursuant to this section, neither the Owner nor Architect/Engineer shall have an obligation to pay or to see to the payment of money to a Subcontractor, except as may otherwise be required by law.
4) Modify Section 9.6.8 by deleting the word 'lien' throughout and replacing it with the words 'Wisconsin Code Chapter 779.'
5) Add new paragraph 9.6.9:
   (a) Payment to the Contractor will be made by the Owner from cash on hand from such sources as may be legally available.
   (b) Add subparagraph 9.6.8.1 as follows:
      (1) Payment to Contractor will be made by Owner from cash on hand from such sources as may be legally available.
6) Delete Section 9.7 and substitute the following:
   (a) If Owner does not pay the Contractor within sixty (60) days after the Contractor submits an Application for Payment to the Architect, the Contractor may file a claim in accordance with Article 15 of this Contract.

e. 9.8 Substantial Completion
   1) Add the following language to the end of Paragraph 9.8.1:
      (a) , subject only to completion of minor punch list items, the absence of completion of which does not interfere with Owner's intended use of Project. The Contractor assumes the responsibility for notifying the Architect in writing when the Project is complete and ready for inspection and review by Architect. This letter to the Architect shall include the date after which the Contractor will be ready for final review and inspection. Designated portions of the Work will be reviewed separately.
   2) Add new Paragraph 9.8.6:
      (a) The Contractor shall reimburse the Owner for any Architect/Engineer's Additional Services and/or attorneys' fees incurred as a result of Contractor's failure to finally complete the Work within sixty (60) days after date specified in the Contract Documents for Project Substantial Completion, or subsequently modified by Change Orders or dates established in the Certificate of Substantial Completion. Reimbursement for these additional services will be deducted by the Owner from the amounts due the Contractor and paid directly to the Architect/Engineer. For purposes of this paragraph "incurred as a result of" includes any architectural fees charged to Owner as Additional Fees under the contract due to the fact that the services were performed sixty (60) days (or some other amount of time specified in the Owner/Architect Agreement) after Substantial Completion. The nature of the services performed (and whether they would have otherwise been performed as normal closeout services at some point under Basic Services) is not relevant to the Contractor's obligations for reimbursement under this section if the contract between the Owner and Architect states that any and all services and related fees are defined as Additional Services solely because they were

performed more than sixty (60) days (or some other amount of time specified in the Owner/Architect Agreement) after Substantial Completion.

f. Add new subparagraph 9.8.7:
   1) 9.8.7.1 Request for Early Release of Retainage Funds:
      (a) 9.8.7.1.1 Upon achieving Substantial Completion, as defined by Wisconsin Code, the Contractor may formally request the release of all or part of the retainage funds being held on the Project. The Contractors' request for Release of the Retainage Funds shall be accompanied by a sworn statement that ten (10) calendar days prior to filing the Request for Release of the Funds a notice was given to all known subcontractors, sub-subcontractors and suppliers that the Contractor is requesting the early release of retainage funds. If proper documentation is received from the Contractor, the Owner will release all retainage funds at the next monthly Owner / Library meeting or within thirty (30) days, whichever is less, except it may retain the following:
      (b) 9.8.7.1.2 An amount equal to 200% of the value of labor or materials yet to be provided on the Project as determined by the Owner and its authorized contract representative. For purposes of this section, “authorized contract representative” means the Architect of record on the Project, unless otherwise specified.
      (c) 9.8.7.1.3 An amount equal to 200% of the value of any claims currently on file at the time the Request for Release of Retainage is approved.
      (d) 9.8.7.1.4 If the Owner withholds an amount from the retainage payment to the Contractor, the Owner will provide a reason the request is being denied to the Contractor within thirty (30) calendar days of the receipt of the request.
      (e) 9.8.7.1.5 Operation, Maintenance, and Warranty Manuals and Record Drawings and Specifications.

g. Add Paragraph 9.8.8
   1) If proper documentation requested in Subparagraph 9.8.7 is received from Contractor, Owner shall make payment due Contractor at Owner's next monthly City Council meeting or within thirty (30) days, whichever is less, except the Owner may retain the following to the extent authorized by law:
      (a) .1 An amount equal to two hundred percent (200%) of the value of labor and materials yet to be provided on the Project as determined by the Owner and its authorized contract representative. For purposes of this Section, “authorized contract representative” means the Architect. Final values to be withheld shall be determined by the Architect/Engineer based on initial estimates provided by Contractor and Architect/Engineer's on-site visits and observations.
      (b) .2 Double the amount of any Wisconsin Code claims currently on file.
      (c) .3 An amount equal to one-half percent (½) of the total value of the Project for Operation, Maintenance, and Warranty Manuals and Record Drawings and Specifications not submitted ten (10) days prior to Substantial Completion inspection.

h. Add Paragraph 9.8.9
   1) If the Owner withholds any amounts of retained funds, the Architect/ Engineer, on behalf of the Owner, shall provide an itemization and list of reasons why amounts are being withheld within thirty (30) calendar days of receipt of request.

i. Add the Sections 9.8.10 through 9.8.14 as follows:
   1) 9.8.10 Warranties required by the Contract Documents will commence on the Date of Substantial Completion of the Work unless otherwise provided in the Certificate of Substantial Completion or the Contract Documents.
   2) 9.8.11 Upon execution of the Certificate of Substantial Completion, the Contractor will deliver custody and control of such Work to the Owner. The

Owner will thereafter provide the Contractor reasonable access to such Work to permit the Contractor to fulfill the correction, completion and other responsibilities remaining under the Contract and the Certificate of Substantial Completion.

3) 9.8.12 Unless otherwise provided in the Certificate of Substantial Completion, the Contractor must complete or correct all items included in the final Punch List within sixty (60) days, subject to the availability of special order parts and materials, after the Date of Substantial Completion.
4) 9.8.13 Not later than ten (10) days after the date of Substantial Completion, the Contractor shall furnish to the Architect/Engineer all Closeout Documentation identified in General Requirements (Division 1 of the Specifications). Except with the consent of the Owner, the Architect/Engineer will perform Closeout Documentation review only during the sixty (60) day period following Substantial Completion. The Owner shall be entitled to deduct from the Contract Sum amounts paid to the Architect/Engineer for additional reviews beyond the 60 day time period identified.
5) 9.8.14 At the time of Substantial Completion, in addition to removing rubbish and leaving the building “broom clean,” the Contractor must replace any broken or damaged materials, remove stains, spots, marks and dirt from decorated Work, clean all fixtures, vacuum all carpets and wet mop all other floors, replace HVAC filters, clean HVAC coils, and comply with such additional requirements, if any, which may be specified in the Contract Documents.

j. 9.10 Final Completion And Final Payment
1) Delete Paragraphs 9.10.1 through 9.10.5 and add the following:
(a) 9.10.1 When the Contractor has completed or corrected all items on the final Punch List and considers that the Work is complete and ready for final acceptance, the Contractor must give written notice to the Owner and the Architect and request a final inspection of the Work as provided in Section 9.10.2. The Contractor’s notice and request for a final inspection must be accompanied by a final Application for Payment and the Submittals required by Section 9.10.3.
(1) 9.10.1.1 The Architect/Engineer will perform no more than one (1) inspection to determine whether the Work or a designated portion thereof has attained Final Completion in accordance with the Contract Documents. The Owner is entitled to reimbursement from the Contractor for amounts paid to the Architect/Engineer for any additional inspections.
(b) 9.10.2 Upon receipt of the Contractor’s notice and request for final inspection, the Owner and the Architect will promptly make such inspection and, when the Owner and the Architect concur that the Work has been fully completed and is acceptable under the Contract Documents, the Architect will issue a Certificate of Final Completion to the Owner. The Contractor’s notice and request for final inspection constitutes a representation by the Contractor to the Owner and the Work has been completed in full and strict accordance with terms and conditions of the Contract Documents. The Architect will promptly notify the Contractor if the Owner or the Architect do not concur that the Work is finally complete. In such case, the Contractor must bear the cost of any additional services of the Owner or the Architect until the Work is determined to be finally complete services of the Owner or the Architect until the Work is determined to be finally complete. In addition to these and any other conditions set forth in the Construction Loan Disbursement Agreement, final payment shall not become due until 30 days after acceptance by the project by the City Council. All lien releases and waivers shall be in the form prescribed by Owner (in compliance with applicable law) as a condition to payment.

(c) 9.10.2.1 The Contractor shall provide Project Record Documents, Operation and Maintenance Manuals, Instruction to Owner's personnel, Final Cleaning and other closeout procedures specified elsewhere.

(d) 9.10.3 Final Payment will be made no earlier than thirty-one (31) days following approval by the Owner / Library at a regularly scheduled meeting, receipt of all Claim Releases, Sales Tax information, and all other required closeout documents, and subject to the conditions of and in accordance with the provisions of Wisconsin Code. Owner may withhold from final payment any and all amounts required to reimburse the Owner for all costs, fees (including reasonable attorney's fees) it incurred as a result of any Claims filed on the project. Neither final payment nor any remaining retained percentage will become due until the Contractor submits the following documents to the Architect.

(1) 9.10.3.1 An Affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner), have been paid or otherwise satisfied, submitted on AIA Document G706, Affidavit of Payment of Debts and Claims (latest edition) or such other form as may be prescribed by the Owner.

(2) 9.10.3.2 A certificate evidencing that the Contractor's liability insurance and Performance Bond remain in effect during the one-year correction period following Substantial Completion as set forth in Section 12.2.2.1 and 12.2.2.2;

(3) 9.10.3.3 A written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents;

(4) 9.10.3.4 Consent of surety to final payment, submitted on AIA Document G707 (latest edition) or other form prescribed by the Owner;

(5) 9.10.3.5 Other data required by the Owner establishing payment or satisfaction of obligations, such as receipts, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be prescribed by the Owner;

(6) 9.10.3.6 A certified building location survey and as-built site plan in the form and number required by the Contract Documents.

(7) 9.10.3.7 All warranties and bonds required by the contract Documents; and

(8) 9.10.3.8 Record Documents as provided in Section 3.2.2 and return of Contract Documents as provided therein.

(9) 9.10.3.9 Release or waiver of liens and Wisconsin Code claims on behalf of Contractor and similar release or waiver on behalf of each Subcontractor and supplier, accompanied by AIA Document G706A, Affidavit of Release of Liens (latest edition) or such other form as may be prescribed by Owner;

k. Add new paragraph 9.11:

1) The Contractor and the Contractor's surety, if any, shall be liable for and shall pay the Owner for any extra costs for engineering or architectural services, construction observation services and related expenses necessitated by the delayed prosecution of the work by the Contractor beyond the date of Final Completion required by the Agreement. Such costs are in no way a penalty, but represent additional expenses to the Owner caused by the Contractor's delay in completing the Work.

l. Add paragraph 9.12:

1) No assignment by the Contractor of any principal contract or any part thereof, or of the funds to be received thereunder by the Contractor, will be recognized

unless such assignment has had the written approval of the Owner and the Surety has been given due notice of such assignment and has furnished written consent thereto. In addition to the usual recitals in the Assignment Contract, the following language must be set forth: "It is agreed that the funds to be paid to the Assignee under this Assignment are subject to prior lien/Wisconsin Code claims for services rendered on materials supplied for the performance of all work called for in said Contract, in favor of all persons, firms or corporations rendering such services supplying such materials."

27. Article 10: Protection of Persons and Property
    a. Add sub-paragraph 10.1.1 as follows:
        1) Contractor shall take all necessary precautions to keep the site and work in compliance with the safety and health regulations for construction issued by the Bureau of Labor Standards of the U.S. Department of Labor as well as the Occupational Safety and Health Standards parts 1910 and 1926 as amended and as enforced by the State of Wisconsin.
    b. Modify subparagraph 10.2.2 as follows:
        1) Add a new subpargraph 10.2.2.1 as follows:
            (a) Contractors shall comply with the Smoke Free Air Act while on Owner property and shall not smoke or use any tobacco while on Owner property. Owner property shall include, but not be limited to, inside private Contractor or employee owned vehicles while parked on Owner property.
    c. Add Section 10.2.4.1 to Section 10.2.4:
        1) When use or storage of explosives, or other hazardous materials, substances or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall give the Owner reasonable advance notice.
    d. Add Section 10.2.5.1 to Section 10.2.5:
        1) Contractors required remedial action for damage and loss to property referred to in Sections 10.2.1.2 and 10.2.1.3 shall repair the damaged materials and surfaces to their original condition, or better, to the satisfaction of the Owner. All such repairs are the responsibility of the Contractor and shall be accomplished at no additional cost to the Owner.
    e. Add subparagraph 10.2.9 to paragraph 10.2:
        1) 10.2.9 At the end of the day's work, all new work likely to be damaged shall be covered. During cold weather protect all work from damage. If low temperatures make it impossible to continue operations safely in spite of cold weather precautions, work shall cease after notifying Architect/Engineer. All other protective measures not mentioned above which may be required shall be furnished by the particular contractor responsible for such protection.
    f. Add subparagraph 10.2.10 to paragraph 10.2:
        1) 10.2.10 Contractor shall construct and maintain all necessary temporary drainage and do all pumping necessary to keep excavations free of water.
    g. Add subparagraph 10.2.11 to paragraph 10.2:
        1) 10.2.11 Contractor shall at all times, protect the excavation, trenches and/or the buildings from damage or rain water, spring water, ground water, backing up of drains, or sewers, etc. Provide all pumps, equipment, and enclosures to give this protection.
    h. Add subparagraph 10.2.12 to paragraph 10.2:
        1) 10.2.12 Contractor shall provide all shoring, bracing, and sheeting as required for safety and for the proper execution of the Work. Remove when work is completed.
    i. Modify Section 10.3.1 by deleting the word "notify" in line six and replacing it with the words "report the condition in writing to".
    j. Section 10.3.3 is hereby deleted.
    k. Delete Section 10.4 and substitute the following:

1) In an emergency affecting safety of persons or property, the Contractor must take all necessary action, without the necessity for any special instruction or authorization from the Owner or Architect, to prevent threatened damage, injury or loss. The Contractor must promptly, but in all events with twenty-four (24) hours of the emergency, report such action in writing to the Owner and Architect. If the Contractor incurs additional costs on account of or is delayed by such emergency, the Contractor may request a change in the Contract Sum or Contract Time to account for such additional costs or delay in accord with Articles 7, 8 and 15. The Contractor must file any such request within ten (10) days of the emergency or it is deemed waived. Any adjustment in the Contract Sum or Contract time shall be limited to the extent that the emergency work is not attributable to the fault or neglect of the Contractor or otherwise the responsibility of the Contractor under the Contract Documents.

28. Article 11: Insurance and Bonds
    a. Section 11.1.1 shall be deleted and replaced with Exhibit A to these Supplementary Conditions, which is attached hereto and incorporated by reference herein.
    b. Section 11.1.2 shall be deleted and replaced with the following:
        1) The Contractor shall furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder. Bonds may be obtained through the Contractor's usual source and the cost thereof shall be included in the Contract Sum. The amount of each bond shall be equal to one hundred percent (100%) of the Contract Sum.
            (a) .1 The Contractor shall deliver the required bonds to the Owner not later than ten (10) days following the date the Agreement is entered into, or, if the Work is to be commenced prior thereto in response to a letter of intent, the Contractor shall, prior to the commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be furnished.
            (b) .2 The Contractor shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of the power of attorney.
            (c) .3 The Contractor shall require the bonding company to be registered with authority to transact business in State of Wisconsin.
29. Add the following subparagraphs:
    a. 11.1.4 Off Site Storage
        1) The Contractor shall provide insurance coverage for portions of the Work stored off the site after written approval of the Owner at the value established in the approval, and also for portions of the Work in transit.
30. 11.2 Owner’s Insurance
    a. Add the following to the last sentence of Subparagraph 11.2.1:
        1) Owner's all risk insurance will be provided by Owner with customary exclusions of certain perils.
    b. Add the following subparagraph:
        1) 11.2.1.1 This property insurance is written with a deductible of $1000.00 per occurrence. In the event of a paid claim, the Claimant, including subcontractors, shall be responsible for the deductible amount. Vandalism insurance shall not cover glass breakage. Should the Contractor desire this coverage, Contractor shall carry it at Contractor’s cost. Payments of any insurance deductibles will be at the expense of the party claiming loss under the policy.
31. Article 12 UNCOVERING AND CORRECTION OF WORK
    a. Add the words "upon written authorization from Owner" between the words "Architect" and "be uncovered" in 2nd line of Section 12.1.1.
    b. Add the words "upon written authorization from Owner" between the words "any request" and "to see" in 2nd line of Section 12.1.2.
    c. Delete Section 12.2.1 and substitute the following:

1) The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, discovered before Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

d. Delete Section 12.2.2.1 and substitute the following:
   1) In addition to Contractor's obligations under Section 3.5, if, within one (1) year after date of Substantial Completion of Work or designated portion thereof or after date of commencement of warranties established under any other provision of Contract Documents, or by terms of an applicable special warranty required by Contract Documents, any of Work is found not to be in accordance with requirements of Contract Documents, Contractor shall correct it promptly after receipt of written notice from Owner to do so. Owner shall give such notice promptly after discovery of condition. Before commencing correction of Work, Contractor shall submit to Owner written description of their proposed repairs. This proposal shall be approved by Design Professional before Contractor commences repair. Once Contractor has completed repair work, they shall notify Owner and Design Professional who shall promptly review corrected work. If Design Professional or Owner rejects corrected Work, Contractor shall continue with repairs until such time as Design Professional and Owner accept corrected Work. Where Contractor corrects defective Work during initial two (2) year period after Substantial Completion, if Owner discovers defects in corrected Work within one (1) year after repairs are made, then Contractor shall be obligated, upon written notice from Owner, to correct such defects within one (1) year from date that repairs were made.

e. Add Section 12.2.6 to Section 12.2 as follows:
   1) If Contractor fails or refuses to correct Work in accordance with their obligations under Contract Documents after written notice from Owner, then Owner may correct Work and Contractor shall be liable for costs to correct Work, any related architectural, engineering or other consulting costs, attorney's fees and expenses, and fines or penalties, if any. Any amounts due to Owner from Contractor under this Section may be withheld from balance of Contract Sum not yet paid.

32. Article 13 Miscellaneous Provisions
   a. Delete Paragraph 13.1 and substitute the following Subparagraph:
      1) The Contract shall be governed by the laws of the State of Wisconsin.
   b. Add Subparagraph 13.1.1 to Paragraph 13.1 as follows:
      1) Compliance with Law Provision: the Contractor agrees that it will comply with all applicable Federal, State and local laws, statutes, codes, rules, and regulations having jurisdiction over the Project. Contractor shall take all necessary precautions to keep the site and work in compliance with the safety and health regulations for construction issued by the Bureau of Labor Standards of the U.S. Department of Labor as well as the Occupational Safety and Health Standards, as amended and as enforced by the State of Wisconsin.
   c. Delete Subparagraph 13.2.2 in its entirety.
   d. Add the following after the 2nd sentence in Section 13.4.1:
      1) Contractor shall schedule all tests, inspections, or specific approvals required by law or Contract Documents so as to avoid any delay in Work.
   e. Add Section 13.4.7 to Section 13.4.
      1) In addition to tests required by Section 13.5, Owner may at any time arrange for other tests, inspections and specific approvals to be performed by others selected by Owner, at Owner's expense. Contractor shall cooperate with Owner and provide access to Work for such tests, inspections and approvals.

f. Delete Paragraph 13.5 and substitute the following Paragraph:
   1) Payments due and unpaid under the Contract Documents shall bear interest from the date the payment is due and shall bear interest at the rate established by Wisconsin Code.

33. Add Sections 13.6 through 13.9 to Article 13:
   a. 13.6 Owner's Right to Occupy
      1) Owner shall have the right to occupy, without prejudice to rights of either party, any completed or largely completed portion of structure or Work, notwithstanding the fact that time for completing entire Work, or such portion thereof, may not have expired. Such occupancy and use shall not be an acceptance of Work taken or used.
   b. 13.7 Rebates
      1) Owner shall have the right to apply for, and secure all rebates which are available when Bids are received. Contractor shall provide invoices, itemizations, and cooperation to the Owner in this regard.
   c. 13.8 Conformance with Laws
      1) The Contractor shall conform with provisions of Federal Civil Rights Act. The Contractor shall comply with applicable federal, state, and local laws, rules, regulations, ordinances, policies and procedures, including Owner's policies and procedures, and Smoke Free Air Act. The Contractor shall require similar clauses in all of their subcontracts for service or materials.
   d. 13.9 Equal Opportunity
      1) 13.9.1 The Contractor shall maintain policies of employment as follows:
         (a) 13.9.1.1 The Contractor and the Contractor's Subcontractors shall not discriminate against any employee or applicant for employment because of race, creed, religion, color, sex, national origin, ancestry, familial status, age, mental or physical disability, sexual orientation, gender identity, genetic information or any other protected class under state or federal law. The Contractor shall take affirmative action to insure that applicants are employed, and that employees are treated during employment without regard to their race, creed, religion, color, sex or national origin, ancestry, familial status, age, mental or physical disability, sexual orientation, gender identity, genetic information or any other protected class under state or federal law. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the policies of non-discrimination.
         (b) 13.9.1.2 The Contractor and the Contractor's Subcontractors shall, in all solicitations or advertisements for employees placed by them or on their behalf, state that all qualified applicants will receive consideration for employment without regard to race, creed, religion, color, sex, national origin, ancestry, familial status, age, mental or physical disability, sexual orientation, gender identify, genetic information or any other protected class under state or federal law.

34. Modify Article 14 as follows:
   a. 14.1.1 Delete subparagraph 14.1.1 in its entirety and replace with the following:
      1) Contractor has no right to stop Work as consequence of non-payment. In event of any disagreement between Contractor and Owner involving Contractor's entitlement to payment, Contractor's only remedy is to file Claim in accordance with Article 15. Contractor shall diligently proceed with Work pending resolution of Claim.

(a) .1 If, however, an Application for Payment has been approved for payment by Owner, and Owner fails to make payment within sixty (60) days of approval of payment by Owner, Contractor may upon ten (10) day written notice to Owner, stop work if payment is not made by Owner within ten (10) days following notice.

b. Delete subparagraphs 14.1.2 through 14.1.4 in their entirety.

c. Delete Sections 14.2.1 through 14.2.4 and substitute the following:

1) 14.2.1 Delete the section in its entirety and replace with the following:

(a) 14.2.1 The Owner may terminate the Contract for cause if the Contractor:

(1) Fails to supply adequate properly skilled workers or proper materials;

(2) Fails to make payment to Subcontractors or Suppliers for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors or Suppliers;

(3) Fails to comply with any laws, ordinances, or rules, regulations or orders of a public authority having jurisdiction;

(4) Fails to perform the Work in accordance with the Contract Documents or otherwise breaches any provision of the Contract Documents;

(5) Anticipatory breaches or repudiates the Contract;

(6) Fails to make satisfactory progress in the prosecution of the Work required by the Contract; or

(7) Endangers the performance of this Contract.

2) 14.2.2 Delete the section in its entirety and replace with the following:

(a) 14.2.2 Owner may terminate Contract, in whole or in part, whenever Owner determines that sufficient grounds for termination exist as provided in Section 14.2.1. Owner will provide Contractor with written notice to cure default. If default is not cured, termination for default is effective on date specified in Owner's written notice. However, if Owner determines that default contributes to curtailment of an essential service or poses an immediate threat to life, health, or property, Owner may terminate Contract immediately upon issuing oral or written notice to Contractor without any prior notice or opportunity to cure. In addition to any other remedies provided by law or Contract, Contractor shall compensate Owner for additional costs that foreseeably would be incurred by Owner, whether costs are actually incurred or not, to obtain substitute performance. Termination for default is termination for convenience if termination for default is later found to be without justification.

3) 14.2.3 Upon receipt of written notice from the Owner of termination, the Contractor must:

(a) .1 Cease operations as directed by the Owner in the notice and, if required by the Owner and County, participate in an inspection of the Work with the Owner, County and the Architect to record the extent of completion thereof to identify the Work remaining to be completed or corrected, and to determine what temporary facilities, tools, equipment and construction machinery are to remain at the Site pending completion of the Work;

(b) .2 Complete or correct the items directed by the Owner, and take actions necessary, or that the Owner may direct, for the protection and preservation of any stored materials and equipment and completed Work;

(c) .3 Unless otherwise directed by the Owner, remove its tools, equipment and construction machinery from the Site; and

(d) .4 Except as directed by the Owner, terminate all existing subcontracts and purchase orders and enter into further subcontracts or purchase orders.

4) 14.2.4 Following written notice from the Owner of termination, the Owner may:

(a) Take possession of the Site and of all materials and equipment thereon, and at the Owner’s option, such temporary facilities, tools, construction equipment and machinery thereon owned or rented by the Contractor that

the Owner elects to utilize in completing the Work;
(1) Accept assignment of subcontracts and purchase orders, and
(2) Complete the Work by whatever reasonable method the Owner may deem expedient.

d. Add Sections 14.2.5 through 14.2.9 to Section 14.2:
1) 14.2.5 Upon termination for cause, the Contractor must take those actions described in Section 14.2.3, and the Owner may take those actions described in Section 14.2.4, subject to the prior rights of the Contractor's Surety.
2) 14.2.6 When the Owner terminates the Contract for cause, the Contractor is not entitled to receive further payment until the Work is completed and the costs of completion have been established.
3) 14.2.7 If the unpaid balance of the Contract Sum less amounts which the Owner is entitled to offset from the unpaid Contract balance, including actual or Liquidated Damages, compensation for the Architect's services and expenses made necessary thereby, and other damages and expenses incurred by the Owner, including reasonable attorney's fees, exceeds the costs of completing the Work, including compensation for the Owner's and the Architect's services made necessary thereby, such excess will be paid to the Contractor or Surety, as directed by the Surety. If such costs exceed the unpaid Contract balance, the Contractor must pay the difference to the Owner upon written demand. This obligation for payment survives termination of the Contract.
4) 14.2.8 In completing the Work following termination for cause, the Owner is not required to solicit competitive bids or to award completion work to the lowest bidder, but may obtain such completion work and related services on the basis of sole source procurement and negotiated compensation.
5) 14.2.9 If the Contractor files for protection, or a petition is filed against it, under the Bankruptcy laws, and Contractor wishes to affirm the Contract, Contractor shall immediately file with the Bankruptcy Court a motion to affirm the Contract and shall provide satisfactory evidence to Owner and to the Court of its ability to cure all present defaults and its ability to timely and successfully complete the Work. If Contractor does not make such an immediate filing, Contractor accepts that Owner shall petition the Bankruptcy Court to lift the Automatic Stay and permit Owner to terminate the Contract.

35. Delete subparagraphs 14.4.1 through 14.4.3 in their entirety and replace with the following:
a. 14.4.1 The Owner may, at any time, terminate the Contract or any portion thereof or the Work for the Owner's convenience and without cause.
b. 14.4.2 Upon receipt of the written notice from the Owner of termination, the Contractor must:
1) .1 Cease operations as directed by the Owner in the notice and, if required by the Owner, participate in an inspection of the Work with the Owner and the Architect/Engineer to record the extent of completion thereof, to identify the Work remaining to be completed or corrected, and to determine what temporary facilities, tools, equipment and construction machinery are to remain at the Site pending completion of the Work;
2) .2 Complete or correct the items directed by the Owner, and take actions necessary, or that the Owner may direct, for the protection and preservation of any stored materials and equipment and completed Work;
3) .3 Unless otherwise directed by the Owner, remove its tools, equipment and construction machinery from the Site, and
4) .4 Except as directed by the Owner, terminate all existing subcontracts and purchase orders related to the Work and enter into no further subcontracts or purchase orders therefor.
c. 14.4.3 Following written notice from the Owner of termination, the Owner may:

1) .1 Take possession of the Site and of all materials and equipment thereon, and at the Owner's option, such temporary facilities, tools, construction equipment and machinery thereon owned or rented by the Contractor that the Owner elects to utilize in completing the Work;
2) .2 Accept assignment of subcontracts and purchase orders; and
3) .3 Complete the Work by whatever reasonable method the Owner may deem expedient.

d. 14.4.4 In case of termination for the Owner's convenience, the Contractor will be entitled to compensation only for the following items:
1) Payment for acceptable Work performed up to the date of termination;
2) The costs of preservation and protection of the Work if requested to do so by the Owner;
3) The cost of terminating the following contracts including:
(a) .1 Purchased materials but only if not returnable and provided to the Owner, or the restocking or return charge, if any, if returnable at the Owner's written election;
(b) .2 Equipment rental contracts if not terminable at no cost but not to exceed an amount equal to thirty (30) days rental;
(c) .3 Documented transportation costs associated with removing Contractor-owned equipment.
(d) .4 Documents demobilization and close-out costs; and
(e) .5 Overhead and profit on the foregoing not to exceed ten percent (10%).
4) The Contractor will not be compensated for the cost of terminating subcontracts, which must be terminable at no cost to the Owner if the Contract is terminated.
5) The Contractor will not be compensated for the cost of any idled employees unless the employee is under a written employment contract entitling the employee to continued employment after termination of the Contract and the employee cannot be assigned to other work provided that in all events the Contractor's costs must be limited to thirty (30) days of employment costs from the date of the notice of termination. The Contractor is not entitled to any other costs or compensation (including lost or expected profit, uncompensated overhead or related expenses, or the cost of preparing and documenting its compensable expenses under this Subsection 14.4.4 as a consequence of the Owner's termination of the Contract for convenience). The Contractor conclusively and irrevocably waives its right to any other compensation or damages (compensatory or punitive) arising from termination of the Contract. If the Owner and the Contractor are unable to agree upon the amounts specified in this subsection, the Contractor may submit a Claim as provided in Article 15. The Claim must be limited to resolution of the amounts specified in Subsections14.4.4.1, 14.4.4.2, 14.4.4.3 and 14.4.4.4 of this Subsection 14.4.4. No other cost, damages or expenses may be claimed or paid to the Contractor or considered as part of the Claim, the same being hereby conclusively and irrevocably waived by the Contractor. Any such Claim must be delivered to the Owner within thirty (30) days of the termination of the Contract and must contain a written statement setting forth the specific reasons and supporting calculations and documentation as to the amounts the Contractor claims to be entitled to under this Subsection as a result of the termination of the Contract.

e. 14.4.5 The Contractor's obligations surviving final payment under the Contract, including without limitation those with respect to insurance, indemnification, and correction of Work that has been completed at the time of termination, remains effective notwithstanding termination for convenience of the Owner.

36. Delete Section 15.1.1 text and substitute the following:
a. A Claim is a written demand or assertion by Contractor seeking, as matter of right, payment of money, a change in the Contract Time, or other relief with respect to terms of Contract. Responsibility to substantiate Claims shall rest with Contractor.

Nothing contained in this section is intended to apply to or in any way limit Owner's right to make claims related to or arising out of Contract.

37. Delete the words “Substantial Completion” in line 4 of Section 15.1.2 and replace it with “Final Acceptance.”
38. Delete the last sentence of Section 15.1.2.
39. Delete Section 15.1.3.1 and substitute the following:
    a. Claims by Contractor shall be initiated by written notice to Owner and to Initial Decision Maker with copy sent to Architect/Engineer, if Architect/Engineer is not serving as Initial Decision Maker. Claims by Contractor shall be initiated within ten (10) days after occurrence of event giving rise to such Claim or within ten (10) days after Contractor first recognizes condition giving rise to Claim, whichever is later. As condition of making claim for additional costs, Contractor shall maintain and produce accurate records to substantiate all additional costs actually incurred. If Claim for actual cost is approved, Owner shall pay Contractor actual costs incurred plus either (a) ten percent (10%) for overhead and profit for work performed by Contractor, or (b) five percent (5%) overhead and profit for work performed by subcontractor, as applicable.
40. Delete Section 15.1.4.1 and substitute the following:
    a. Pending final resolution of Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, Contractor shall proceed diligently with performance of Contract and Owner shall continue to make payments as may be required in accordance with Contract Documents.
41. Delete Section 15.1.6.2 and substitute the following:
    a. If adverse weather conditions are the basis of a Claim for additional time, the Claim shall be documented by data substantiating that the weather conditions upon which the Claim is based (1) were abnormal when compared to the previous 5-year period, during the same time frame and at the location of the Work, (2) could not have been reasonably anticipated, and (3) had an adverse effect on the date of substantial completion of the Work.
42. Add Subparagraph 15.1.6.3 and 15.1.6.4 to Subparagraph 15.1.6:
    a. 15.1.6.3 Claims for increase in the Contract Time shall set forth in detail the circumstances that form the basis for the Claim, the date upon which each cause of delay began to affect the progress of the Work, the date upon which each cause of delay ceased to affect the progress of the Work and the number of days’ increase in the Contract Time claimed as a consequence of each such cause of delay. The Contractor shall provide such supporting documentation as the Owner may require including, where appropriate, a revised construction schedule indicating all the activities affected by the circumstances forming the basis of the Claim.
    b. 15.1.6.4 The Contractor shall not be entitled to a separate increase in the Contract Time for each one of the number of causes of delay which may have concurrent or interrelated effects on the progress of the Work, or for concurrent delays due to the fault of the Contractor.
43. Delete Subparagraph 15.1.7 in its entirety.
44. Modify the first sentence of Section 15.2.1 to read as follows:
    a. Claims, excluding those arising under Sections 10.3, 10.4 and 11.5 shall be referred to the Initial Decision Maker for initial decision.
45. Delete Subparagraph 15.2.6 and substitute the following:
    a. The parties may file for mediation of an initial decision at any time, upon mutual agreement of the parties.
46. Delete Subparagraphs 15.2.6.1 and 15.2.8 in their entirety.
47. Delete Subparagraph 15.3.1 in its entirety.
48. Delete Section 15.3.2 and substitute the following:
    a. The parties shall endeavor in good faith to resolve claims, disputes and other matters in question between them by mutual agreement and may, by mutual agreement and in their discretion, submit same to non-binding mediation which shall be in

accordance with Wisconsin Code, unless otherwise mutually agreed upon by the parties. Requests for mediation shall be given in writing to the other Party to this Agreement. If the Owner and Contractor are unable to mutually agree upon mediator in writing within fourteen (14) days of receiving written request for mediation, either party may then institute legal or equitable proceedings. Mediation shall be voluntary only and shall not be a prerequisite to litigation or other means of dispute resolution.

49. Delete Section 15.3.3.
50. Delete Subparagraph 15.4 and replace with the following:
    a. Any legal claim brought under this Agreement shall be filed in the Wisconsin District Court in and for Walworth County, unless otherwise mutually agreed to by the parties.
51. Add Article 16 as follows:
    a. Smoking will not be allowed on Owner's property, which shall include inside private vehicles parked on Owner's property. In addition, employees of Contractor, Subcontractors, and materials suppliers shall not wear apparel that advertises tobacco, alcohol, or illicit drugs, nor has profane language or images on them.

EXHIBIT A - City of Delavan

MINIMUM INSURANCE REQUIREMENTS:

COMMERCIAL GENERAL LIABILITY:

General Aggregate Limit	$2,000,000
Products - Completed Operation Aggregate Limit	$2,000,000
Personal and Advertising Injury Limit	$1,000,000
Each Occurrence Limit	$1,000,000
Damage to a Premises Rented to You Limit	$ 100,000
Medical Payments	$ 5,000

Commercial General Liability policy shall be written on an occurrence form using ISO form CG 00 01 or equivalent form.

Policy shall include the following endorsements:

ISO endorsement CG 20 10 or equivalent endorsement naming the City of Delavan and the Delavan Public Library, its board members, employees and agents as an additional insured.

ISO endorsement CG 20 32 or equivalent endorsement naming Project Engineers, Architects and Surveyors as an additional insured.

ISO endorsement CG 20 37 or equivalent endorsement naming the City of Delavan and the Delavan Public Library, its board members, employees and agents as an additional insured for completed operations. This endorsement shall be maintained for a minimum of two years after completion and acceptance of the project by the City of Delavan .

ISO Endorsement CG 20 01 or equivalent endorsement indicating additional insured status for the City of Delavan and the Delavan Public Library, its board members, employees and agents is primary and non-contributory.

ISO endorsement CG 25 03 or equivalent endorsement, Designated Construction Project(s) General Aggregate Limit.

ISO endorsement CG 24 04 or equivalent endorsement, Waiver of Transfer of Rights of Recovery Against Others to Us, naming the City of Delavan and the Delavan Public Library.

Governmental Immunities Endorsement (see attached specimen).

BUSINESS AUTOMOBILE LIABILITY:

Combined single limit of	$1,000,000

Or

Bodily Injury (per person)	$1,000,000
Bodily Injury (per accident)	$1,000,000
Property Damage	$1,000,000

Business auto liability shall be written on ISO form CA 00 01 or equivalent form.

Policy shall include Symbol 1 (Any Auto). If no owned autos, hired and non-owned auto liability is acceptable.

Include ISO endorsement CA 04 44 or equivalent endorsement, Waiver of Transfer of Rights of Recovery Against Others to Us, naming the City of Delavan and the Delavan Public Library.

Include ISO endorsement CA 99 48, Pollution Liability - Broadened Coverage for Covered Autos, or equivalent endorsement if the Contractor has vehicles that transport fuel onto City of Delavan property.

WORKERS COMPENSATION & EMPLOYERS LIABILITY:

Workers Compensation - Statutory - State of Wisconsin

Employers Liability

Bodily Injury Limit Each Accident	$500,000
Bodily Injury Disease - Policy Limit	$500,000
Bodily Injury Disease - Limit Each Employee	$500,000

Workers Compensation shall include the following endorsement: WC 0003 13, Waiver of Our Right to Recover from Others, in favor of the City of Delavan and the Delavan Public Library.

Sole Proprietors, Partners and Members must be included for coverage. Executive Officers may not be excluded from coverage.

UMBRELLA OR EXCESS LIABILITY:

Limit Each Occurrence	$5,000,000
Aggregate Limit	

Umbrella or Excess liability policy shall provide excess coverage and be at least as broad in coverage as the following required policies and endorsements: Commercial General Liability, Business Auto and Employer's Liability.

City of Delavan

GOVERNMENTAL IMMUNITIES ENDORSEMENT

Nonwaiver of Governmental Immunity. The insurance carrier expressly agrees and states that the purchase of this policy and the including of City of Delavan and the Delavan Public Library as an Additional Insured does not waive any of the defenses of governmental immunity available to the City of Delavan under Wisconsin Code as it now exists and as it may be amended from time to time.

Claims Coverage. The insurance carrier further agrees that this policy of insurance shall cover only those claims not subject to the defense of governmental immunity under the Wisconsin Code as it now exists and as it may be amended from time to time. Those claims not subject to the provisions shall be covered by the terms and conditions of this

insurance policy.

Assertion of Governmental Immunity. The City of Delavan shall be responsible for asserting any defense of governmental immunity, and may do so at any time and shall do so upon the timely written request of the insurance carrier.

Non-Denial of Coverage. The insurance carrier shall not deny coverage under this policy and the insurance carrier shall not deny any of the rights and benefits accruing to the City of Delavan and the Delavan Public Library under this policy for reasons of governmental immunity unless and until a court of competent jurisdiction has ruled in favor of the defense(s) of governmental immunity asserted by the City of Delavan .

No Other Change in Policy. The above preservation of governmental immunities shall not otherwise change or alter the coverage available under the policy.

ACKNOWLEDGMENT AND CERTIFICATION

("Company") is providing services to the City of Delavan ("Owner / Library ") as a vendor, supplier, or contractor or is operating or managing the operations of a vendor, supplier or contractor. The services provided by the Company may involve the presence of the Company's employees upon the real property of the Owner / Library .

The Company acknowledges that Wisconsin law prohibits a sex offender who has been convicted of a sex offense against a minor from being present upon the real property of the Owner / Library . The Company further acknowledges that, pursuant to law, a sex offender who has been convicted of a sex offense against a minor may not operate, manage, be employed by, or act as a contractor, vendor or supplier of services or volunteer at the Owner / Library .

The Company hereby certifies that no one who is an owner, operator or manager of the Company has been convicted of a sex offense against a minor. The Company further agrees that it shall not permit any person who is a sex offender convicted of a sex offense against a minor to provide any services to the Owner / Library in accordance with the prohibitions set forth above.

This Acknowledgment and Certification is to be construed under the laws of the State of Wisconsin. If any portion hereof is held invalid, the balance of the document shall, notwithstanding, continue in full legal force and effect.

In signing this Acknowledgment and Certification, the person signing on behalf of the Company hereby acknowledges that he/she has read this entire document that he/she understands its terms, and that he/she not only has the authority to sign the document on behalf of the Company, but has signed it knowingly and voluntarily.

Dated:_____

By: _____
(name of vendor/supplier/contractor/sub-contractor)
a.
Printed Name: _____

Title: _____

END OF SECTION

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SECTION 01 10 00
SUMMARY

PART 1 GENERAL

1.01 PROJECT

A. Project Name: Delavan Public Library Addition and Renovation

B. Owner / Library's Name: City of Delavan.

C. Architect's Name: FEH DESIGN.

D. The Work of Project is defined by the Contract Documents and consists of the following of expansion and renovation of the existing library building, and associated site work..
   1. Expansion of the existing, historic library. The addition is comprised of concrete footings and foundations, braced steel frame, brick and cast stone wall over metal studs, concrete slab-on-grade and composite metal floor deck, and steel joist with metal roof deck. The existing, historic library is wood framed with masonry exterior with an 1980s addition of metal framing with masonry exterior walls.
   2. Overexcavation and backfill of existing soils to support the building.
   3. Replacement of existing elevator cab.
   4. The mechanical system will be primarly new units and ductwork. Plumbing will be new in the expansion and modified in the existing building. The project includes electrical system expansion and renovation as well as new fire protection and updated / new technology systems.
   5. Regrading and landscaping of the site for the expansion. Associated parking lot and drive lane revisions.
   6. And other Work indicated in the Contract Documents.

1.02 CONTRACT DESCRIPTION

A. Contract Type: A single prime contract based on a Stipulated Price as described in Document 00 52 00 - Agreement Form.

1.03 DESCRIPTION OF ALTERATIONS WORK

A. Scope of demolition and removal work is indicated on drawings and specified in Section 02 41 00.

B. The contractor shall remove and turn over to the owner the following items:
   1. Existing donor items and existing plaques.

C. Contractor shall remove and store the following prior to start of work, for later reinstallation by Contractor:

1.04 WORK BY OWNER

A. Owner / Library will award a contract for supply and installation of the following items which will commence on the end of construction:
   1. Furnishings.

B. Items noted NIC (Not in Contract) will be supplied and installed by Owner / Library after Substantial Completion. Some items include:
   1. Small equipment.

C. Owner / Library will supply the following for installation by Contractor:
   1. Lite Brite Wall in Youth Area.
   2. Appliances.
   3. Owner-Provided Artwork
   4. Bike Fix-It Station.
   5. Solar Benches
   6. Wall-Mounted Items in Discover Zone
   7. Adult Changing Station

8. Book Lockers in West Vestibule

1.05 OWNER OCCUPANCY

A. The owner intends to move offsite during construction, but plans to store materials on the upper level of the existing building during construction.

B. Owner / Library intends to occupy the entire Project upon Substantial Completion.

1.06 CONTRACTOR USE OF SITE AND PREMISES

A. Construction Operations: Limited to site.
   1. Locate and conduct construction activities in ways that will limit disturbance to site.
   2. Contractor shall have use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner access into and out of the building for infrequent library purposes.
   3. The owner plans to store materials and furniture on the upper level of the existing building that must be protected and maintained by the contractor.

B. Arrange use of site and premises to allow:
   1. Work by Owner / Library.

C. Provide access to and from site as required by law and by Owner / Library:
   1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
   2. Driveways, Walkways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or for storage of materials.
      a. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
   3. Do not obstruct roadways, sidewalks, or other public ways without permit.

D. Work Restrictions
   1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

E. Time Restrictions:
   1. Limit work in the existing building to normal business working hours of 7:00 a.m. to 10:00 p.m., Monday through Friday, unless otherwise indicated. Work hours bay be modified to meet Project requirements if approved by Owner and authorities having jurisdiction.

F. Utility Outages and Shutdown:
   1. Limit disruption of utility services to hours the building is unoccupied.
   2. Prevent accidental disruption of utility services to other facilities.

1.07 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
   1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
   2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations and scheduled on Drawings.

1.08 MISCELLANEOUS PROVISIONS

A. Contractor shall comply with the stricter of the local, state, or federal recommendations related to the pandemic (COVID-19).
   1. Contractor to provide the Owner with a site-specific safety plan related to COVID-19.

1.09 WORK SEQUENCE

A. Coordinate construction schedule and operations with Owner / Library.

B. Coordinate construction schedule and operations with Architect.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 01 20 00
PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedures for preparation and submittal of applications for progress payments.

B. Documentation of changes in Contract Sum and Contract Time.

C. Change procedures.

D. Procedures for preparation and submittal of application for final payment.

1.02 RELATED REQUIREMENTS

A. Section 00 50 00 - Contracting Forms and Supplements: Forms to be used.

B. Section 00 73 00 - Supplementary Conditions: Percentage allowances for Contractor's overhead and profit.

C. Section 01 78 00 - Closeout Submittals: Project record documents.

1.03 SCHEDULE OF VALUES

A. Use Schedule of Values Form: AIA G703, edition stipulated in the Agreement.

B. Coordination: Coordinate preparation of the schedule of values with preparation of Contract's construction schedule.
   1. Correlate line items in the schedule of values with other required administrative forms and schedules, including the following:
      a. Application for Payment forms with continuation sheets.
      b. Submittal Schedule
      c. Items required to be indicated as separate activities in Contractor's construction schedule.
      d. Contractor's construction schedule.

C. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Architect for approval.

D. Forms filled out by hand will not be accepted.

E. Submit Schedule of Values in duplicate within 15 days after date of Owner-Contractor Agreement.

F. Achitect will review the Initial Schedule of Values and make marks to indicate corrections or modifications required. Architect will not review or approve the Initial Application for Payment until the Initial Schedule of Values has been approved.

G. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification section. Identify site mobilization.

H. Provide a breakdown of major cost items in the General Conditions as separate line items. Include the following line items, applicable to the Project, as part of the contractor's normal breakdown.
   1. General Conditions
   2. Bond, Insurance
   3. Supervision
   4. Mobilization
   5. Demobilization
   6. Permits and fees
   7. Shop Drawings / Engineering (included here in General Conditions or as part of individual products in subsequent sections).
   8. Record Documents
   9. Temporary Facilities: refer to paragraph below.

I. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual Table of Contents. Provide multiple line items for principal subcontract amoutns in excess of five percent of Contract Sum.

J. Round amounts to nearest whole dollar; total shall equal the Contract Sum.

K. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
   1. Differentiate between items stored on-site and items stored off-site. For any materials stored offsite, include evidence of insurance and provide standard ACCORD insurance form.

L. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.

M. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
   1. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.

N. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

O. Revise schedule to list approved Change Orders, with each Application For Payment.

1.04 APPLICATIONS FOR PROGRESS PAYMENTS

A. Payment Period: Submit at intervals stipulated in the Agreement.

B. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect, and paid for by Owner.
   1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

C. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.

D. Forms filled out by hand will not be accepted.

E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
   1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
   2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
   3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

F. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
   1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
   2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
   3. Provide summary documentation for stored materials indicating the following:

a. Materials previously stored and included in previous Applications for Payment.
b. Work completed for this Application utilizing previously stored materials.
c. Additional materials stored with this Application.
d. Total materials remaining stored, including materials with this Application.

4. Retainage: Deduct 5% from the completed work covered by each Application for Payment until the project is Substantially Completed, as determined by the Architect, at which time an application for 95% of the total net amount earned can be submitted.
5. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
   a. List of subcontractors with address and telephone number.
   b. Schedule of values.
   c. Contractor's construction schedule (preliminary if not final).
   d. Submittal schedule (preliminary if not final). Electronic Submittal Website may be used if timeline for submittals is utilized.
   e. List of Contractor's staff assignments.
   f. Copies of building permits.
   g. Report of preconstruction conference.
   h. Certificates of insurance and insurance policies.
   i. Performance and payment bonds.

G. For each item, provide a column for listing each of the following:
1. Item Number.
2. Description of work.
3. Scheduled Values.
4. Previous Applications.
5. Work in Place and Stored Materials under this Application.
6. Authorized Change Orders.
7. Total Completed and Stored to Date of Application.
8. Percentage of Completion.
9. Balance to Finish.
10. Retainage.

H. Execute certification by signature of authorized officer.

I. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.

J. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of work.

K. Submit one digital copy of each Application for Payment.

L. Include the following with the application:
1. Transmittal letter as specified for submittals in Section 01 30 00.
2. Construction progress schedule, revised and current as specified in Section 01 30 00.
3. Partial release of liens from major subcontractors and vendors.

M. When Architect requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.

1.05 MODIFICATION PROCEDURES

A. For minor changes not involving an adjustment to the Contract Sum or Contract Time, Architect will issue instructions directly to Contractor.
1. Architect will use AIA Document G710, "Architect's Supplemental Instructions."
2. The Contractor will review and sign the ASI, if in agreement with it, and return to Architect. Contractor will have 5 business days to review distributed ASI and comment and sign. If the Contractor has an objection, clarifications, or modifications to the ASI, the Contractor must respond with the 5 business days. After 5 business days, or with no comments, the

ASI will become final and part of the Contract Documents.

B. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
   1. Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
   2. Within time specified in Proposal Request or 14 calendar days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
      a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
      b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
      c. Include costs of labor, equipment, subcontracted work, and supervision directly attributable to the change. Furnish itemized data to substantiate costs of material, taxes, freight, equipment, and labor.
      d. Quotation Form: Use forms acceptable to Architect.

C. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.
   1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
   2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
   3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
   4. Include costs of labor, equipment, subcontracted work, and supervision directly attributable to the change. Furnish itemized data to substantiate costs of material, taxes, freight, equipment, and labor.
   5. Proposal Request Form: Use AIA Document G709 or form acceptable to Architect

D. For other required changes, Architect will issue a document signed by Owner / Library instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
   1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
   2. Promptly execute the change.
   3. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
      a. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
      b. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
      c. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.
      d. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
      e. Promptly execute the change.

E. For changes for which advance pricing is desired, Architect will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change with a stipulation of any

overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within Ten (10) days.

F. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
   1. For pre-determined unit prices and quantities, the amount will based on the fixed unit prices.
   2. For change ordered by Architect without a quotation from Contractor, the amount will be determined by Architect based on the Contractor's substantiation of costs as specified for Time and Material work.

G. Substantiation of Costs: Provide full information required for evaluation.
   1. On request, provide the following data:
      a. Quantities of products, labor, and equipment.
      b. Taxes, insurance, and bonds.
      c. Overhead and profit.
      d. Justification for any change in Contract Time.
      e. Credit for deletions from Contract, similarly documented.
   2. Support each claim for additional costs with additional information:
      a. Dates and times work was performed, and by whom.
      b. Time records and wage rates paid.
      c. Invoices and receipts for products, equipment, and subcontracts, similarly documented.
   3. For Time and Material work, submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.

H. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.
   1. On Owner's approval of a Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

I. A change order may include Contractor responses to one or more Proposal Requests (and / or Construction Change Directives) that have been approved.

J. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.

K. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.

L. Promptly enter changes in Project Record Documents.

M. The Contractor shall include all adjustments to the Contract Sum in all subsequent Applications for Payment only after receipt of a fully executed copy of each Change Order.

1.06 LIEN WAIVERS

A. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.
   1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
   2. When an application shows completion of an item, submit conditional final or full waivers.
   3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
   4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.

1.07 APPLICATION FOR SUBSTANTIAL COMPLETION PAYMENT

A. After issuance of the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
   1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
   2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
   3. Submit the "Certificate of Substantial Completion Request Form" included in this Project Manual. Review of project will not take place until receipt of this signed form.

1.08 APPLICATION FOR FINAL PAYMENT

A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.

B. Application for Final Payment will not be considered until the following have been accomplished:
   1. All closeout procedures specified in Section 01 70 00.
   2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
   3. Updated final statement, accounting for final changes to the Contract Sum.
   4. AIA Document G707, "Consent of Surety to Final Payment."
   5. Evidence that claims have been settled.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 21 00
ALLOWANCES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Contingency allowance.

B. Payment and modification procedures relating to allowances.

1.02 RELATED REQUIREMENTS

A. Section 01 20 00 - Price and Payment Procedures: Additional payment and modification procedures.

1.03 CONTINGENCY ALLOWANCE

A. Contractor's costs for products, delivery, installation, labor, insurance, payroll, taxes, bonding, equipment rental, overhead and profit will be included in Change Orders authorizing expenditure of funds from this Contingency Allowance.

B. Funds will be drawn from the Contingency Allowance only by Change Order.

C. At closeout of Contract, funds remaining in Contingency Allowance will be credited to Owner by Change Order.

1.04 ALLOWANCES SCHEDULE

A. Contingency Allowance: Include the stipulated sum/price of **$300,000** for use upon Owner's instructions.

B. Historic Roof Allowance: Include the stipulated sum/price of **$20,000** for use repairing the existing gutters on the historic library building to make it watertight.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 01 22 00
UNIT PRICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. List of unit prices, for use in preparing Bid. Unit prices to be used IN ADDITION to base bid.

B. Measurement and payment criteria applicable to Work performed under a unit price payment method.

1.02 RELATED REQUIREMENTS

A. Document 00 21 13 - Instructions to Bidders: Instructions for preparation of pricing for Unit Prices.

B. Section 01 20 00 - Price and Payment Procedures: Additional payment and modification procedures.

1.03 COSTS INCLUDED

A. Unit Prices included on the Bid Form shall include full compensation for all required labor, products, tools, equipment, plant, transportation, services and incidentals; erection, application or installation of an item of the Work; overhead and profit for work in addition to the base bid.

1.04 UNIT QUANTITIES SPECIFIED

A. Quantities indicated in the Bid Form are for bidding and contract purposes only. Quantities and measurements of actual Work will determine the payment amount.

1.05 MEASUREMENT OF QUANTITIES

A. Take all measurements and compute quantities. Measurements and quantities will be verified by Architect.

B. Assist by providing necessary equipment, workers, and survey personnel as required.

C. Stipulated Price Measurement: Items measured by weight, volume, area, or linear means or combination, as appropriate, as a completed item or unit of the Work.

1.06 PAYMENT

A. Payment for Work governed by unit prices will be made on the basis of the actual measurements and quantities of Work that is incorporated in or made necessary by the Work and accepted by the Architect, multiplied by the unit price.

B. Payment will not be made for any of the following:
   1. Products wasted or disposed of in a manner that is not acceptable.
   2. Products determined as unacceptable before or after placement.
   3. Products not completely unloaded from the transporting vehicle.
   4. Products placed beyond the lines and levels of the required Work.
   5. Products remaining on hand after completion of the Work.
   6. Loading, hauling, and disposing of rejected Products.

1.07 SCHEDULE OF UNIT PRICES

A. Unit Price 1: Subgrade Stabilization Excavation
   1. Description: Excavate unforeseen unsatisfactory areas under proposed pavements and foundations; dispose of off site, according to the owner-provided geotechnical testing agent. The base bid shall include excavation identified in the bid documents and the geotechnical report that is required for project.
   2. Unit of Measurement: Cubic yards of area excavated based on field measurements.

B. Unit Price 2: Subgrade Stabilization Backfill
   1. Description: Furnish, place, and compact material per Civil specification section 31 23 33 "Trenching and Backfilling" and the geotechnical report. The base bid shall include backfill identified in bid documents and geotechnical report that is required for project.

2. Unit of Measurement: Ton, base on certified rock tickets from quarry.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 23 00
ALTERNATES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Description of Alternates.

1.02 RELATED REQUIREMENTS

A. Document 00 21 13 - Instructions to Bidders: Instructions for preparation of pricing for Alternates.

1.03 ACCEPTANCE OF ALTERNATES

A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner / Library's option. Accepted Alternates will be identified in the Owner-Contractor Agreement.

B. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

1.04 SCHEDULE OF ALTERNATES

A. Alternate No. 1 - Existing Building Mechanical Upgrades:
   1. Base Bid Item: The base bid shall include replacement of the two existing AHUs with one exterior-mounted RTU, exterior fencing, modifications to existing ductwork required to accomodate the new mechanical unit, and wall /ceiling modifications.
   2. Alternate Item: The alternate bid will include retaining the existing AHUs and outdoor fenced condensing units. The alternate bid will include updates to the perimeter heat controls, clean the ductwork, and replace dirty grilles. Minimal wall / ceiling modifications.

B. Alternate No. 2 - Irrigation System:
   1. Base Bid Item: The base bid shall not include an irrigation system.
   2. Alternate Item: The alternate bid shall include an irrigation system, as indicated on the landscape drawings.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 01 30 00
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General administrative requirements.

B. Electronic document submittal service.

C. Preconstruction meeting.

D. Site mobilization meeting.

E. Progress meetings.

F. Construction progress schedule.

G. Coordination drawings.

H. Submittals for review, information, and project closeout.

I. Number of copies of submittals.

J. Requests for Interpretation (RFI) procedures.

K. Submittal procedures.

1.02 RELATED REQUIREMENTS

A. Section 00 72 00 - General Conditions: Dates for applications for payment.

B. Section 01 32 16 - Construction Progress Schedule: Form, content, and administration of schedules.

C. Section 01 60 00 - Product Requirements: General product requirements.

D. Section 01 70 00 - Execution and Closeout Requirements: Additional coordination requirements.

E. Section 01 78 00 - Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.

1.03 GENERAL ADMINISTRATIVE REQUIREMENTS

A. Comply with requirements of Section 01 70 00 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.

B. Make the following types of submittals to Architect:
   1. Requests for Interpretation (RFI).
   2. Requests for substitution.
   3. Shop drawings, product data, and samples.
   4. Test and inspection reports.
   5. Design data.
   6. Manufacturer's instructions and field reports.
   7. Applications for payment and change order requests.
   8. Progress schedules.
   9. Coordination drawings.
   10. Correction Punch List and Final Correction Punch List for Substantial Completion.
   11. Closeout submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 ELECTRONIC DOCUMENT SUBMITTAL SERVICE

A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF, MS Word, or MS Excel) format, as appropriate to the document, and transmitted via an Internet-based submittal service that receives, logs and stores documents, provides electronic

stamping and signatures, and notifies addressees via email.

1. Besides submittals for review, information, and closeout, this procedure applies to Requests for Interpretation (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.
2. Contractor and Architect are required to use this service.
3. It is Contractor's responsibility to submit documents in allowable format.
4. Subcontractors, suppliers, and Architect's consultants are to be permitted to use the service at no extra charge.
5. Users of the service need an email address, internet access, and PDF review software that includes ability to mark up and apply electronic stamps (such as Adobe Acrobat, www.adobe.com, or Bluebeam PDF Revu, www.bluebeam.com), unless such software capability is provided by the service provider.
6. Paper document transmittals will not be reviewed; emailed electronic documents will not be reviewed.
7. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.

B. Cost: The cost of the service is to be paid by Contractor; include the cost of the service in the Contract Sum.

C. Submittal Service: The selected service is:
   1. Submittal Exchange (tel: 1-800-714-0024): www.submittalexchange.com/#sle.

D. Training: One, one-hour, web-based training session will be arranged for all participants, with representatives of Architect and Contractor participating; further training is the responsibility of the user of the service.

E. Project Closeout: Architect will determine when to terminate the service for the project and is responsible for obtaining archive copies of files for Owner / Library.

3.02 PRECONSTRUCTION MEETING

A. Architect will schedule a meeting after Notice of Award.

B. Attendance Required:
   1. Owner / Library.
   2. Architect.
   3. Contractor.
   4. Sub-contractors.
   5. Architect's consultants.

C. Agenda:
   1. Execution of Owner - Contractor Agreement
   2. Submission of executed bonds and insurance certificates.
   3. Distribution of Contract Documents.
   4. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
   5. Designation of personnel representing the parties to Contract .
   6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
   7. Construction scheduling.
   8. Critical work sequencing and long-lead items.
   9. Procedures for RFIs.
   10. Procedures for testing and inspecting.
   11. Use of the premises.
   12. Work restrictions.

13. Working hours.
14. Responsibility for temporary facilities and controls.
15. Procedures for disruptions and shutdowns.
16. Use of site and storage areas.
17. Equipment deliveries and priorities.
18. First aid.
19. Security.
20. Progress cleaning.

D. Contractor shall record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner / Library, participants, and those affected by decisions made.

3.03 SITE MOBILIZATION MEETING

A. Schedule meeting at the Project site prior to Contractor occupancy.

B. Attendance Required:
1. Contractor.
2. Owner / Library.
3. Architect.
4. Contractor's superintendent.
5. Major subcontractors.

C. Agenda:
1. Use of premises by Owner / Library and Contractor.
2. Owner / Library's requirements.
3. Construction facilities and controls provided by Contractor.
4. Temporary utilities provided by Contractor.
5. Survey and building layout.
6. Security and housekeeping procedures.
7. Schedules.
8. Application for payment procedures.
9. Procedures for testing.
10. Procedures for maintaining record documents.
11. Requirements for start-up of equipment.
12. Inspection and acceptance of equipment put into service during construction period.

D. Contractor shall record minutes and distribute copies within two days after meeting to participants, with copies to Architect, Owner / Library, participants, and those affected by decisions made.

3.04 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the work at maximum bi-monthly intervals.

B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

C. Attendance Required:
1. Contractor.
2. Owner / Library.
3. Architect.
4. Contractor's superintendent.
5. Major subcontractors.

D. Agenda:
1. Review minutes of previous meetings.
2. Review of work progress.
3. Field observations, problems, and decisions.

4. Identification of problems that impede, or will impede, planned progress.
5. Review of submittals schedule and status of submittals.
6. Review of RFIs log and status of responses.
7. Review of off-site fabrication and delivery schedules.
8. Maintenance of progress schedule.
9. Corrective measures to regain projected schedules.
10. Planned progress during succeeding work period.
11. Coordination of projected progress.
12. Maintenance of quality and work standards.
13. Effect of proposed changes on progress schedule and coordination.
14. Other business relating to work.

E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner / Library, participants, and those affected by decisions made.

F. Contractor's Coordination Meeting:
   1. Conduct Project Coordination Meeting at weekly intervals or as needed. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and Pre-Construction conferences.

3.05 CONSTRUCTION PROGRESS SCHEDULE

A. Within 10 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 60 days of work, with a general outline for remainder of work.

B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.

C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
   1. Include written certification that major contractors have reviewed and accepted proposed schedule.

D. Within 10 days after joint review, submit complete schedule.

E. Submit updated schedule with each Application for Payment.

F. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

3.06 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly demolition of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.

B. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.

C. Make adequate provisions to accommodate items scheduled for later installation.

D. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

E. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities, and activities of other contractors, to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
   1. Preparation of Contractor's construction schedule.
   2. Preparation of the schedule of values.
   3. Installation and removal of temporary facilities and controls.
   4. Delivery and processing of submittals.

5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.

3.07 COORDINATION DRAWINGS

A. Review drawings prior to submission to Architect.

B. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where items are not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
   1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
      a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
      b. Indicate required demolition sequences.

C. Coordination Drawing Organization: Organize coordination drawings as follows:
   1. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make changes as directed and resubmit.

3.08 REQUESTS FOR INFORMATION (RFI)

A. Definition: A request seeking one of the following:
   1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.

B. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.

C. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents and if not possible to request interpretation at the next Project Meeting, the **Contractor is to call the Architect** to review and determine if an RFI is required. If so determined by the Contractor and Architect, the Contractor shall prepare and submit an RFI in the form specified.
   1. For any RFIs submitted to Architect by other entities controlled by Contractor, Architect will return with no response.
   2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

D. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
   1. Official Project name and number, and any additional required identifiers established in Contract Documents.
   2. Owner / Library's, Architect's, and Contractor's names.
   3. Discrete and consecutive RFI number, and descriptive subject/title.
   4. Issue date, and requested reply date.
   5. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).

6. Annotations: Field dimensions and/or description of conditions which have engendered the request.
7. Contractor's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.
8. Contractor's signature.

E. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.
   1. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

F. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
   1. Indicate current status of every RFI. Update log promptly and on a regular basis.
   2. Note dates of when each request is made, and when a response is received.
   3. Highlight items requiring priority or expedited response.
   4. Highlight items for which a timely response has not been received to date.

G. RFI Forms: AIA Document G716 or a Software-generated form with substantially the same content as indicated above, acceptable to Architect.
   1. Attachments shall be electronic files in Adobe Acrobat PDF format.

H. Review Time: Architect will respond and return RFIs to Contractor within seven working days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.
   1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.

I. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner / Library.
   1. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.
   2. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.
   3. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.
   4. Notify Architect within seven calendar days if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.

J. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
   1. The following Contractor-generated RFIs will be returned without action:
      a. Requests for approval of submittals.
      b. Requests for approval of substitutions.
      c. Requests for approval of Contractor's means and methods.
      d. Requests for coordination information already indicated in the Contract Documents.
      e. Requests for adjustments in the Contract Time or the Contract Sum.
      f. Requests for interpretation of Architect's actions on submittals.
      g. Incomplete RFIs or inaccurately prepared RFIs.

2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Proposal Request according to Section 01 2000 "Contract Modification Procedures."
    a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 7 days of receipt of the RFI response.
    b. After 7 calendar days, with no response from contractor, the RFI is considered acceptable with no changes to Contract Time or Contract Sum. No additional compensation will be considered after the 7 days.

3.09 SUBMITTAL SCHEDULE

A. Submit to Architect for review a schedule for submittals in tabular format.
1. Submit at the same time as the preliminary schedule specified in Section - 01 32 16 - Construction Progress Schedule.
2. Coordinate with Contractor's construction schedule and schedule of values.
3. Format schedule to allow tracking of status of submittals throughout duration of construction.
4. Arrange information to include scheduled date for initial submittal, specification number and title, submittal category (for review or for information), description of item of work covered, and role and name of subcontractor.
5. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.
    a. For assemblies, equipment, systems comprised of multiple components and/or requiring detailed coordination with other work, allow for additional time to make corrections or revisions to initial submittals, and time for their review.

3.10 SUBMITTALS FOR REVIEW

A. When the following are specified in individual sections, submit them for review:
1. Product data.
    a. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
        1) If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
        2) Include the following information, as applicable:
            (a) Manufacturer's catalog cut sheets; include only cut sheets relevant to this Project.
            (b) Statement of compliance with specified referenced standards.
            (c) Testing by recognized testing agency.
            (d) Notation of coordination requirements.
        3) For equipment, include the following in addition to the above, as applicable:
            (a) Wiring diagrams showing factory-installed wiring.
            (b) Printed performance curves.
            (c) Operational range diagrams.
            (d) Clearances required to other construction, if not indicated on accompanying Shop Drawings.
        4) Submit Product Data in the following format:
            (a) PDF electronic file.
            (b) Color Charts or items requiring true color representation not conducive to scanning or electronic formats:
                (1) Number of Copies: Submit the number of copies to the Architect which the Contractor requires, plus two-(2) which will be retained by the Architect, Architect’s Consultant.
2. Shop drawings.

a. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
   1) Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
      (a) Identification of products.
      (b) Schedules.
      (c) Compliance with specified standards.
      (d) Notation of coordination requirements.
      (e) Notation of dimensions established by field measurement.
      (f) Relationship and attachment to adjoining construction clearly indicated.
      (g) Seal and signature of professional engineer if specified.
   2) Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than (30 by 42 inches)].
   3) Submit Shop Drawings in the following format:
      (a) PDF electronic file.

3. Samples for selection.
   a. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
      1) Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
      2) Submit transmittal of sample shipment, onto the Project Web Site. Transmittal will be returned after 7 calendar days if samples are not received by the Architect’s office.
         (a) Include in the electronic submittal a photograph or scan of the samples being submitted.
      3) Identification: Attach label on unexposed side of Samples that includes the following:
         (a) Generic description of Sample.
         (b) Product name and name of manufacturer.
         (c) Sample source.
         (d) Number and title of applicable Specification Section.
      4) Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
      5) Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor
   b. When color charts are to be used, submit hard copies of the color charts to the Architect after uploading to project's website.
   c. Architect may require physical samples from color charts and will notify Contractor if physical samples are to be submitted in lieu of a color chart.
4. Samples for verification.
   a. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.
   1. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action, as follows:
      a. Final Unrestricted Release: Where submittals are marked "**NO EXCEPTIONS TAKEN**," the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents. Final acceptance will depend on that compliance.
      b. Final-but-Restricted Release: When submittals are marked "**MAKE CORRECTIONS NOTED**," the Work covered by the submittal may proceed provided it complies with both the Architect's notations and corrections on the submittal and requirements of the Contract Documents. Final acceptance will depend on that compliance.
      c. Returned for Resubmittal: When submittal is marked "**REVISE AND RESUBMIT**" or "**REJECTED**" or "**NOT REVIEWED - NO INFORMATION PROVIDED**," do not proceed with the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal according to the Architect's notations. Resubmit without delay. Repeat if necessary to obtain a different action mark.
         1) Do not permit submittals marked "**REVISE AND RESUBMIT**" or "**REJECTED**" or "**NOT REVIEWED - NO INFORMATION PROVIDED**,"to be used at the Project Site or elsewhere where construction is in progress.
      d. Returned submittal marked "**RECORD DOCUMENT - NOT REVIEWED**" are for project records only and do not represent any review performed on the submittal by the Design Team.
   2. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
   3. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.
   4. Incomplete submittals are not acceptable, will be considered nonresponsive, and will be returned without review.
   5. Submittals not required by the Contract Documents may not be reviewed and may be discarded.
   6. Submittals that clearly demonstrate lack of review by the Contractor will be immediately be returned without review.
   7. The Architect's review of these submittals is only for general conformance with the design concept of the work and general compliance with the information given in the Contract Documents. Any action shown is subject to the requirements of the drawings and specifications.
   8. The review is not intended to be exhaustive; nor is the Architect or Contracting Officer's Representative obligated to verify dimensions, quantities, or the performance of any systems.

C. Samples will be reviewed for aesthetic, color, or finish selection.

D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 78 00 - Closeout Submittals.

3.11 SUBMITTALS FOR INFORMATION

A. When the following are specified in individual sections, submit them for information:
   1. Design data.
   2. Certificates.
   3. Test reports.
      1) Limitations of use.

b. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
c. Field Test Reports: Submit reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

4. Inspection reports.
5. Manufacturer's instructions.
6. Manufacturer's field reports.
7. Subcontractor List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish specialty work including site work or utilities work or crushing activities. Include the following information in tabular form:
   a. Name, address, and telephone number of entity performing subcontract or supplying products.
8. Key Personnel Names: Within 15 days of starting deconstruction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
   a. Post copies of list in project meeting room, and in temporary field office. Keep list current at all times
9. Design data
   a. Delegated Design Services
      1) Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
         (a) If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
      2) Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally-signed PDF electronic file paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
         (a) Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.
10. Other types indicated.

B. Submit for Architect's knowledge as contract administrator or for Owner / Library.

3.12 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit Correction Punch List for Substantial Completion.

B. Submit Final Correction Punch List for Substantial Completion.

C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 01 78 00 - Closeout Submittals:
   1. Project record documents.
   2. Operation and maintenance data.
   3. Warranties.
   4. Bonds.
   5. Other types as indicated.

D. Submit for Owner / Library's benefit during and after project completion.

3.13 NUMBER OF COPIES OF SUBMITTALS

A. Documents for Review:
   1. Small Size Sheets, Not Larger Than 8-1/2 by 11 inches: Submit one copy; the Contractor shall make Contractor's own copies from original returned by the Architect after making a file copy.
   2. Larger Sheets, Not Larger Than 36 by 48 inches: Submit one reproducible transparency and one opaque reproduction.

B. Documents for Information: Submit two copies.

C. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
   1. After review, produce duplicates.
   2. Retained samples will not be returned to Contractor unless specifically so stated.

3.14 SUBMITTAL PROCEDURES

A. General Requirements:
   1. Identification and Information: Identify and incorporate information in each electronic submittal file as follows:
   2. Assemble complete submittal package into a single file for each submittal required. Submit each required submittal at the same time for the whole division.
   3. Name file with submittal number or other unique identifier, including revision identifier.
   4. Provide means for electronic insertion to permanently record Contractor's review and approval markings and action taken by Architect.
   5. Include the following information on a sheet:
      a. Project name.
      b. Date
      c. Name and address of Architect
      d. Name of Contractor
      e. Name of firm or entity that prepared submittal.
      f. Name of subcontractor.
      g. Name of supplier
      h. Name of manufacturer
      i. Number and title of appropriate Specification Section
      j. Drawing number and detail references, as appropriate
      k. Location(s) where product is to be installed, as appropriate
      l. Related physical samples submitted directly
      m. Other necessary identification
   6. Include the following information as keywords in the electronic file metadata
      a. Project name
      b. Number and title of appropriate Specification Section
      c. Product name
   7. Options: Identify options requiring selection by the Architect
   8. Deviations: Identify deviations from the Contract Documents on submittals
      a. Submittals not reviewed by the Contractor and stamped such will be rejected and sent back to the Contractor for review. Contractor to provide enough evidence of review, prior to submitting to the Architect for review. If upon review by the Architect, it is so deemed that the Contractor did not review the submittal based on the amount of corrections that the Architect identifies, the Architect will cease review of the submittal and stamp as Revise and Resubmit without further review.
   9. Re-submittals: Make re-submittals in same form and number of copies as initial submittal.
      a. Note date and content of previous submittal

b. Note date and content of revision in label or title block and clearly indicate extent of revision
c. Resubmit submittals until they are marked with approval notation from Architect's action stamp

10. Distribution: Furnish electronic copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities.
11. Use for Construction: Use only final submittals that are marked with approval notation from Architect's action stamp.
12. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents.
    a. Architect will not review submittals that do not bear Contractor's approval stamp and will return the submittals without action.
13. For each submittal for review, allow 14 days excluding delivery time to and from the Contractor.
    a. <u>No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including re-submittals.</u>
    b. Re-submittal Review: Allow 14 days for review of each re-submittal.
    c. Hardware Submittals: Allow 30 days for the review of this submittal. During this time period, a hardware meeting will be scheduled with the owner, contractor and the AHC to review each opening requirement with adjustments made as needed for operation. Contractor will be required to resubmit the hardware submittal, updated with any modifications.
    d. Building Technology Submittals: Allow 30 days for review of these submittals. During this time period a meeting will be scheduled with the owner, contractor and engineer for review of technology component operations.
14. Architect's Digital Data Files: Electronic copies of PDF versions of “PLAN” Drawings of the Contract Drawings may be provided by Architect, upon request, for Contractor's use in preparing submittals. Electronic copies of CAD Drawings of the Contract Drawings will not be provided by Architect for Contractor's use in preparing submittals except as note elsewhere.
    a. Architect will furnish Contractor digital data drawing PDF files of the Contract Drawings for use in preparing Shop Drawings. Copies of Architect’s digital files submitted as a required submittal without additional contractor specified information will be returned to the Contractor.
        1) Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
        2) The following PDF files will by furnished for each appropriate discipline:
            (a) Plan type drawings
            (b) Building detail drawings will not be provided
15. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.

3.15 ELECTRONIC SUBMITTAL REQUIREMENTS

A. The following submittals and paperwork shall be transmitted to Architect in electronic (PDF) format via a website service designed specifically for transmitting submittals between construction team members. The contractor shall use the FTP site for the following information:
    1. Shop drawing submittals
    2. Product data submittals
    3. Requests for Information
    4. Project Directory
    5. Project Correspondence

6. Contractor’s reports
7. Project Meeting Minutes
8. Contract Modification (Change Orders) Logs
9. Request For Information forms, responses and logs
10. Architectural Supplemental Instructions (ASI’s) and logs
11. Online document collaboration files
12. Project photographs and videos
13. Special Inspection reports

B. The electronic submittal process is not intended for the following:
   1. **Color samples, color charts, physical material samples.**
   2. **Applications for Payment, and other submittals not related to shop drawings and product data and not indicated above.**

C. Provide and use project website for purposes of managing project information and documentation noted elsewhere until Final Completion.

3.16 CONTRACTOR'S USE OF ARCHITECT'S CAD FILES

A. General: At Contractor's written request, copies of Architect's CAD files may be provided to Contractor for Contractor's use in connection with the Project, subject to the following conditions:
   1. Electronic copies of plan-type drawings will be made available at a cost of $150.00 payable to the Architect, for each requested drawing. Electronic copies will be distributed upon receipt of service fee and signed agreement.
   2. Contractor making request shall not distribute files to other parties.

B. Contractor making request shall provide a signed copy of the CAD/ELECTRONIC FILE TRANSFER TO CONTRACTOR form.

4.01 CAD/ELECTRONIC FILE TRANSFER TO CONTRACTOR

Dear Contractor requesting Files:

At your request, FEH DESIGN and it's Consultants may provide electronic files for your convenience and use in the preparation of shop drawings related to the Delavan Public Library Addition and Renovation, subject to the following terms and conditions:

Our electronic files are generated into AutoCAD drawing files. FEH DESIGN and it's Consultants makes no representation as to the compatibility of these files with your hardware or your software. Please advise FEH DESIGN of the desired AutoCAD version you are requesting.

Data contained on these electronic files are part of our instruments of service and shall not be used by you for any purpose other than as a convenience in the preparation of the shop drawings for the referenced project. Any other use or reuse by you or by others will be at your sole risk and without liability or legal exposure to FEH DESIGN or our Consultants. You agree to make no claim and hereby waive, to the fullest extent permitted by law, any claim or cause of action of any nature against FEH DESIGN, our officers, directors, employees, agents or sub-consultants that may arise out of or in connection with your use of these electronic files.

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_____	_____
(Contractor name and title)	(Officer or Legally Responsible Party)
_____	_____
(Company)	(Title)
_____	_____
(Address)	(Date)

END OF SECTION

SECTION 01 32 16
CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preliminary schedule.

B. Construction progress schedule, bar chart type.

1.02 SUBMITTALS

A. Within 10 days after date of Agreement, submit preliminary schedule.

B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.

C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
   1. Include written certification that major contractors have reviewed and accepted proposed schedule.

D. Within 10 days after joint review, submit complete schedule.

E. Submit updated schedule with each Application for Payment.

F. Submit in PDF format.

1.03 QUALITY ASSURANCE

A. Scheduler: Contractor's personnel or specialist Consultant specializing in CPM scheduling with one years minimum experience in scheduling construction work of a complexity comparable to this Project, and having use of computer facilities capable of delivering a detailed graphic printout within 48 hours of request.

1.04 SCHEDULE FORMAT

A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.

B. Diagram Sheet Size: Maximum 30 x 42 inches.

1.05 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
   1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
   2. Predecessor Activity: An activity that precedes another activity in the network.
   3. Successor Activity: An activity that follows another activity in the network.

B. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

C. Event: The starting or ending point of an activity.

D. Float: The measure of leeway in starting and completing an activity.
   1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
   2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
   3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRELIMINARY SCHEDULE

A. Prepare preliminary schedule in the form of a horizontal bar chart.

3.02 CONTENT

A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.

B. Identify each item by specification section number.

C. Identify work of separate stages and other logically grouped activities.

D. Provide sub-schedules for each stage of Work identified in Section 01 10 00 - Summary.

E. Provide sub-schedules to define critical portions of the entire schedule.
   1. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
      a. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
      b. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Division 01 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
      c. Work Restrictions: Show the effect of the following items on the schedule:
         1) Coordination with existing construction.
         2) Limitations of continued occupancies.
         3) Uninterruptible services.
         4) Use of premises restrictions.
         5) Environmental control.
      d. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
         1) Submittals.
         2) Mockups.
         3) Installation.
         4) Tests and inspections.
         5) Startup and placement into final use and operation.
      e. List critical work and subcontracts here if requirement to indicate stages of the Work is limited only to those elements.
      f. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
         1) Structural Completion.
         2) Temporary enclosure and space conditioning.
         3) Permanent space enclosure.
         4) Completion of mechanical installation.
         5) Completion of electrical installation.
         6) Substantial Completion.

F. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect / Owner.

G. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.

H. Coordinate content with schedule of values specified in Section 01 20 00 - Price and Payment Procedures.

I. Provide legend for symbols and abbreviations used.

J. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect / Owner's & Architect's administrative procedures necessary for certification of Substantial Completion.

K. Punch List and Final Completion: Include not more than 14 days for punch list and final completion.

3.03 BAR CHARTS

A. Include a separate bar for each major portion of Work or operation.

B. Identify the first work day of each week.

3.04 REVIEW AND EVALUATION OF SCHEDULE

A. Participate in joint review and evaluation of schedule with Architect at each submittal.

B. Evaluate project status to determine work behind schedule and work ahead of schedule.

C. After review, revise as necessary as result of review, and resubmit within 10 days.

3.05 UPDATING SCHEDULE

A. Maintain schedules to record actual start and finish dates of completed activities.

B. Indicate progress of each activity to date of revision, with projected completion date of each activity.

C. Annotate diagrams to graphically depict current status of Work.

D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.

E. Indicate changes required to maintain Date of Substantial Completion.

F. Submit reports required to support recommended changes.

G. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
   1. Unresolved issues.
   2. Unanswered RFIs.
   3. Rejected or unreturned submittals.
   4. Notations on returned submittals.

H. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.

I. At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

J. Provide narrative report to define problem areas, anticipated delays, and impact on the schedule. Report corrective action taken or proposed and its effect.

3.06 SPECIAL REPORTS

A. General: Submit special reports directly to Owner within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.

B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

3.07 DISTRIBUTION OF SCHEDULE

A. Distribute copies of updated schedules to Contractor's project site file, to subcontractors, suppliers, Architect, Owner / Library, and other concerned parties.

B. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

C. Post copies in Project meeting rooms and temporary field offices

END OF SECTION

SECTION 01 35 91
PERIOD TREATMENT PROCEDURES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Construction procedures appropriate for working with historic sites and structures.

1.02 RELATED REQUIREMENTS

A. Section 01 10 00 - Summary: Contract descriptions, description of alterations work, work by others, future work, occupancy conditions, use of site and premises, and work sequence.

B. Section 02 03 42 - Removal and Salvage of Period Construction Materials.

C. Section 02 41 00 - Demolition: Selective demolition of nonhistoric elements.

1.03 DEFINITIONS

A. Existing to Remain: Existing items that are not to be removed or dismantled. Protect materials as indicated.

B. Historic: Spaces, areas, rooms, surfaces, materials, finishes, and overall appearance subject to preservation, rehabilitation, restoration, and reconstruction procedures defined in NPS (THP). Designation “HF” and words such as “historic,” “historic fabric,” “historic materials,” “historic building materials,” 'historic character,' or words of similar meaning indicate that the material or feature is considered to have aspects that require period treatment procedures.

C. In-Kind: Matching existing in physical and visual aspects including, but not limited to, material, form, color, texture, and workmanship.

D. Matching: Blending with adjacent construction and showing no apparent difference in material type, form, detail, color, texture, finish, or other visible and readily discernible characteristics, as determined and approved by Architect.

E. Protect: Take precautions to keep historic materials of the building from damage or injury.

F. Refinish: Remove existing finishes from base material and apply new finish to match original or as otherwise indicated.

G. Remove: Detach or dismantle items from existing construction and dispose of them off-site, unless items are indicated to be salvaged or reinstalled.

H. Remove and Reinstall: Detach or dismantle items from existing construction in a manner to prevent damage. Clean and prepare for reuse and reinstall in original location or in other location where indicated.

I. Remove and Salvage: Detach or dismantle items from existing construction in a manner to prevent damage. Clean, package, label, and deliver salvaged items to Owner / Library in ready-for-reuse condition.

J. Repair: Correct damage and defects, retaining existing materials, features, and finishes and employing as few new materials as possible. Includes patching, piecing-in, splicing, consolidating, or reinforcing or upgrading materials with appropriate and approved materials and methods.

K. Replace: Remove, duplicate, and reinstall entire item with new material. Use original item as the pattern unless noted otherwise.

L. Retain: Existing to remain; keep existing items that are not to be removed or dismantled.

M. Stabilize: Provide reinforcement of unsafe or deteriorated items and maintain the present, essential form; reestablish weather-resistant enclosure.

1.04 REFERENCE STANDARDS

A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2022.

B. NPS (THP) - The Secretary of The Interior's Standards For the Treatment of Historic Properties with Guidelines For Preserving, Rehabilitating, Restoring & Reconstructing Historic Buildings; 2017.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by affected installers.

1.06 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Project supervisor's qualification statement.

C. Existing Conditions Documentation: Prior to commencement of period treatment activities, document with digital photography, digital videography, digital photogrammetry, or similar means the existing exterior walls, interior walls, windows, doors, roofs and roofing, interior finishes, trim, decorative elements, and building services equipment and distribution systems indicated as subject to period treatment.

D. Project Record Documents:
   1. Record of conditions encountered before, during, and after completion of work.

1.07 QUALITY ASSURANCE

A. Project Supervisor: Master craftsperson with at least three years of documented experience in leading work similar in size and scope to this project.
   1. Be present when a craftsperson begins to perform the work; explain the intended procedures.

B. Documents at Project Site: Maintain at the project site a copy of each referenced document for execution requirements.

1.08 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 74 19 - Construction Waste Management and Disposal for packaging waste requirements.

B. Storage and Protection:
   1. Use and reuse materials original to the existing structure wherever practical. Store removed materials under cover, inside, and protect from damage.
   2. Label specific pieces or items to be removed. Label consistently and inconspicuously indicating original location, and document original position.
   3. Protect materials during storage and construction from rain, snow, or groundwater and from soiling with earth or other materials.
      a. Store cementitious materials off ground, under cover, and in a dry location. Protect liquid components from freezing.
      b. Comply with manufacturer's recommendations for minimum and maximum temperature requirements for storage.
   4. Store restoration and cleaning chemicals off-site or in metal cabinets on-site. Do not leave cans open or out of the cabinet overnight. Do not store in unlabeled containers.

1.09 FIELD CONDITIONS

A. Smoking and use of tobacco products by personnel performing work on or about designated period treatment areas is not allowed.

B. Environmental Requirements:
   1. Wet or Humid Weather:
      a. Do not remove exterior elements of structures when raining or rain is forecasted.
      b. Do not apply primer, paint, putty, or epoxy when the relative humidity is above 80 percent and in accordance with manufacturer's recommendations.
      c. Do not repair exterior features in rain or fog.

2. Hot Weather: Work in the shade when the temperature is above 75 degrees F. Shield features or areas from excessive heat with protective netting or tarpaulins.
   a. Hot Weather Maximum Application Ambient Temperatures:
      1) Paint: 85 degrees F.
      2) Putty: 80 degrees F.
      3) Epoxy: 80 degrees F.
3. Cold Weather: Do not perform exterior wet work when the air temperature is below 40 degrees F.
   a. Cold Weather Minimum Application Ambient Temperatures:
      1) Paint: 50 degrees F.
      2) Putty: 50 degrees F.
      3) Epoxy: 55 degrees F.
   b. Do not begin cleaning, patching, and similar work when frost or freezing temperatures are forecasted.

C. Exterior Cleaning Procedures: Perform cleaning and rinsing of the exterior elements only during daylight hours.

D. Protection of Existing Elements: In accordance with manufacturer's recommendations for use of proposed products and procedures and compatibility with adjacent historic building materials, components, and vegetation.

PART 2 - PRODUCTS

2.01 PROTECTION PRODUCTS

A. Temporary Interior Enclosures: See Section 01 50 00 - Temporary Facilities and Controls.

B. Adhesive Walk-Off, Tacky Mats: Mats with multiple layers of disposable, adhesive-coated sheets.
   1. Sheet Material: Polyethylene film.
   2. Adhesive: Acrylic.
   3. Applications: Indoor/Outdoor.
   4. Nominal Mat Size: Contractor's option, to provide adequate dirt trapping.
   5. Color: Blue.

2.02 CLEANING MATERIALS

A. General: Do not use incompatible materials that may contribute to damage of the element being cleaned.

B. Use products specifically intended by the manufacturer for cleaning historic materials or elements.

2.03 REPAIR MATERIALS

A. General: Do not use incompatible materials contributing to damage of repaired elements.

B. Matching: Unless otherwise required, use new materials that match historic materials in type, design, dimension, texture, detailing, and external appearance.

PART 3 - EXECUTION

3.01 PERIOD TREATMENT SPECIAL PROCEDURES

A. Selective removal and salvage of identified historic items and materials and removal of rubbish and debris.
   1. Perform work in accordance with requirements of Section 02 03 42.
   2. Historic items and materials are indicated on drawings.

B. Review proposed procedures for each type of element with Architect. Obtain approval from Project Manager before commencing work.

C. Salvage as much existing material of each element as practicable; repair, consolidate, and restore rather than renew.

D. Repair rather than replace architectural features wherever possible. Repair or replace missing features with accurate duplications.

E. Use reversible processes wherever possible.

F. Use methods that do not significantly change the aesthetic effect of existing elements.

G. Document condition of items being worked on before, during, and after work is completed.

H. Provide Owner / Library's written approval of changes, additions, or removal of historic structural fabric or historic property.

I. Notify Owner / Library of visible changes in the integrity of material or components, e.g., environmental, such as biological attack, ultraviolet degradation, freeze-thaw, or structural defects such as cracks, movement, or distortion.

J. Protect existing materials and substrates from damage.

K. Protect existing elements and features removed, cleaned, and reused from material damage.
   1. Label salvaged items and features and store at project site, in designated location; protect from damage.
   2. Permanently label new or replacement materials and features in an unobtrusive manner. Record type of identification and location of labels.

L. Exterior Work Procedures: Protect parts of the facility not included in this work from damage.
   1. Do not attach scaffolding, ladders, and working platforms to building unless approved in writing by the Architect.
   2. Test drain systems to assure proper functioning before performing cleaning operations. Notify Owner / Library if stopped or blocked.
      a. Clean drains and drain lines blocked or filled with sand or solids.
   3. Seal exterior openings to prevent entry of dust, debris, and water into the building.
   4. Protect landscape work adjacent to or within period treatment work areas:
      a. Set scaffolding and ladder legs away from plants. Submit pruning requests to Architect.
      b. Provide plank barriers to protect tree trunks. Bind spreading shrubs.
      c. Use covering methods and materials that allow plants to breathe. Remove covering at the end of each workday. Do not cover plant material with a waterproof membrane for more than 8 hours at one time.

M. Interior Work Procedures: Protect parts of the facility not being cleaned or repaired from effects of this work.
   1. Provide enclosures to protect against spread of dust, debris, and water at or beyond the work area.
   2. Mask or cover adjacent surfaces and permanent equipment. Secure coverings; do not use adhesive type tape or nails. Do not use impervious sheeting.

END OF SECTION

SECTION 01 40 00
QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittals.

B. References and standards.

C. Testing and inspection agencies and services.

D. Control of installation.

E. Mock-ups.

F. Tolerances.

G. Manufacturers' field services.

H. Defect Assessment.

1.02 RELATED REQUIREMENTS

A. Document 00 72 00 - General Conditions: Inspections and approvals required by public authorities.

B. Section 01 30 00 - Administrative Requirements: Submittal procedures.

C. Section 01 42 16 - Definitions.

D. Section 01 42 19 - Reference Standards.

E. Section 01 60 00 - Product Requirements: Requirements for material and product quality.

1.03 DEFINITIONS

A. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

B. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

C. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
   1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
   2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.

C. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner / Library's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.05 REFERENCES AND STANDARDS

A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Comply with reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.

C. Obtain copies of standards where required by product specification sections.

D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.

E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.

F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from Contract Documents by mention or inference otherwise in any reference document.

1.06 QUALITY CONTROL

A. Maintain quality control over suppliers, manufacturer's products, services, site conditions, and workmanship, to produce Work of specified quality. Quality control is the Contractor's primary responsibility.

B. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
   1. Owner will furnish Contractor with names, addresses, and telephone numbers of special inspection testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
   2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

C. The Contractor shall schedule and coordinate all Pre-construction, Pre-Installation, and Construction Testing and Inspection Operations. The Contractor shall provide a minimum of five (5) working days' notice to the owner, and the appropriate firms and/or agencies before starting Work requiring inspection or testing. The Contractor shall provide a minimum of three (3) working days' notice thereafter for each testing or inspection for the continuation of that item with reasonable date and time fixed for such inspections and tests. If the Work is covered up prior to any required testing or observation, it shall be uncovered for review at the Contractor's expense.

D. Contractors shall furnish incidental labor and facilities as necessary.

E. Provide access to the Work to be tested

F. Contractors shall make arrangements with the owner and pay for additional samples and tests taken for Contractor's convenience.

G. Inspection and testing shall in no way relieve the Contractor or supplier from responsibility for furnishing materials and workmanship in accordance with the Contract Documents.

H. Contractors shall comply with other instructions from the Architect regarding testing

I. The Contractor shall pay for all retesting, re-inspection and re-observation costs.

J. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.

K. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.

L. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
   1. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

1.07 TESTING AND INSPECTION AGENCIES AND SERVICES

A. Owner / Library will employ and pay for services of an independent testing agency to perform specified testing.

B. **The contractor is responsible for testing and monitoring on the project outside of the scope noted to be provided by the owner in subsequent specification sections.**

C. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

PART 3 EXECUTION

2.01 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Have work performed by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

2.02 MOCK-UPS

A. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.

B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.

C. Notify Architect fifteen (15) working days in advance of dates and times when mock-ups will be constructed.

D. Provide supervisory personnel who will oversee mock-up construction. Provide workers that will be employed during the construction at Project.

E. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.

F. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

G. Obtain Architect's approval of mock-ups before starting work, fabrication, or construction.
   1. Architect will issue written comments within seven (7) working days of initial review and each subsequent follow up review of each mock-up.
   2. Make corrections as necessary until Architect's approval is issued.

H. Accepted mock-ups shall be a comparison standard for the remaining Work.

I. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear

area when directed to do so by Architect.

2.03 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

2.04 TESTING AND INSPECTION

A. Testing Agency Duties:
   1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
   2. Perform specified sampling and testing of products in accordance with specified standards.
   3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   4. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
   5. Perform additional tests and inspections required by Architect.
   6. Submit reports of all tests/inspections specified.

B. Limits on Testing/Inspection Agency Authority:
   1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Agency may not approve or accept any portion of the Work.
   3. Agency may not assume any duties of Contractor.
   4. Agency has no authority to stop the Work.

C. Contractor Responsibilities:
   1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
   2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
   3. Provide incidental labor and facilities:
      a. To provide access to Work to be tested/inspected.
      b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
      c. To facilitate tests/inspections.
      d. To provide storage and curing of test samples.
   4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
   5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
   6. Arrange with Owner / Library's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

D. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.

E. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

2.05 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance equipment as applicable, and to initiate instructions when necessary.

B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

2.06 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not complying with specified requirements.

B. If, in the opinion of Architect, it is not practical to remove and replace the work, Architect will direct an appropriate remedy or adjust payment.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION

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SECTION 01 42 16
DEFINITIONS

PART 1 GENERAL

1.01 SUMMARY

A. This section supplements the definitions contained in the General Conditions.

B. Other definitions are included in individual specification sections.

1.02 DEFINITIONS

A. Furnish: To supply, deliver, unload, and inspect for damage.

B. Install: To unpack, assemble, erect, apply, place, finish, cure, protect, clean, start up, and make ready for use.

C. Product: Material, machinery, components, equipment, fixtures, and systems forming the work result. Not materials or equipment used for preparation, fabrication, conveying, or erection and not incorporated into the work result. Products may be new, never before used, or re-used materials or equipment.

D. Project Manual: The book-sized volume that includes the procurement requirements (if any), the contracting requirements, and the specifications.

E. Provide: To furnish and install.

F. Supply: Same as Furnish.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 01 42 19
REFERENCE STANDARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Reference standards full title and edition date.

1.02 QUALITY ASSURANCE

A. For products or workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Comply with the reference standard of date of issue specified in this section, except where a specific date is established by applicable code.

C. Should specified reference standards conflict with Contract Documents, request clarification from the Architect before proceeding.

D. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of the Architect shall be altered by Contract Documents by mention or inference otherwise in any reference document.

PART 2 CONSTRUCTION INDUSTRY ORGANIZATION DOCUMENTS

2.01 AAMA -- AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2017a.

2.02 ASTM B SERIES -- ASTM INTERNATIONAL

A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2020.

2.03 ASTM D SERIES -- ASTM INTERNATIONAL

A. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2020.

2.04 AWCI -- ASSOCIATION OF THE WALL AND CEILING INDUSTRIES INTERNATIONAL

A. AWCI 117 - Technical Manual 12-B; Standard Practice for the Testing and Inspection of Field Applied Thin Film Intumescent Fire-Resistive Materials; an Annotated Guide; 2014.

2.05 ICC -- INTERNATIONAL CODE COUNCIL, INC.

A. ICC (IBC)-2018 - International Building Code; 2018.

B. ICC (IECC)-2018 - International Energy Conservation Code; 2018.

C. ICC (IFC)-2018 - International Fire Code; 2018.

D. ICC (IMC)-2018 - International Mechanical Code; 2018.

2.06 MPI -- MASTER PAINTERS INSTITUTE (MASTER PAINTERS AND DECORATORS ASSOCIATION)

A. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

2.07 OTHER REQUIREMENTS

A. Current National Fire Protection Association (NFPA) standards as referenced by the International Fire Code.

B. 2014 Illinois State Plumbing Code with Amendments.

C. 2017 National Electric Code (NFPA 70)

D. 2018 Illinois Accessibility Code.

2.08 NFPA -- NATIONAL FIRE PROTECTION ASSOCIATION

A. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films; 2019.

2.09 SJI -- STEEL JOIST INSTITUTE

A. SJI 100 - Catalog of Standard Specifications Load Tables and Weight Tables for Steel Joists and Joist Girders; 2011.

2.10 SMA -- SCREEN MANUFACTURERS ASSOCIATION

2.11 TMS -- THE MASONRY SOCIETY

A. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.

2.12 UL -- UNDERWRITERS LABORATORIES INC.

A. UL (FRD) - Fire Resistance Directory; Current Edition.

END OF SECTION

SECTION 01 45 33
CODE-REQUIRED SPECIAL INSPECTIONS AND PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Code-required special inspections.

B. Testing services incidental to special inspections.

C. Manufacturers' field services.

D. Fabricators' field services.

1.02 RELATED REQUIREMENTS

A. Document 00 72 00 - General Conditions: Inspections and approvals required by public authorities.

B. Section 01 30 00 - Administrative Requirements: Submittal procedures.

C. Section 01 40 00 - Quality Requirements.

D. Section 01 42 19 - Reference Standards.

E. Section 01 60 00 - Product Requirements: Requirements for material and product quality.

1.03 ABBREVIATIONS AND ACRONYMS

A. AHJ: Authority having jurisdiction.

B. NIST: National Institute of Standards and Technology.

1.04 DEFINITIONS

A. Code or Building Code: ICC (IBC)-2018, Edition of the International Building Code and specifically, Chapter 17 - Special Inspections and Tests.

B. Authority Having Jurisdiction (AHJ): Agency or individual officially empowered to enforce the building, fire and life safety code requirements of the permitting jurisdiction in which the Project is located.

C. Special Inspection:
   1. Special inspections are inspections and testing of materials, installation, fabrication, erection or placement of components and connections mandated by the AHJ that also require special expertise to ensure compliance with the approved Contract Documents and the referenced standards.
   2. Special inspections are separate from and independent of tests and inspections conducted by Owner / Library or Contractor for the purposes of quality assurance and contract administration.

1.05 REFERENCE STANDARDS

A. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2014 (Errata 2018).

B. AISC 360 - Specification for Structural Steel Buildings; 2016.

C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

D. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2020.

E. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field; 2019a.

F. ASTM C172/C172M - Standard Practice for Sampling Freshly Mixed Concrete; 2017.

G. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2023.

H. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2020.

I. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing; 2021.

J. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestops; 2019.

K. ASTM E2393 - Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers; 2010a (Reapproved 2015).

L. AWCI 117 - Technical Manual 12-B; Standard Practice for the Testing and Inspection of Field Applied Thin Film Intumescent Fire-Resistive Materials; an Annotated Guide; 2014.

M. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020.

N. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2018.

O. AWS D1.4/D1.4M - Structural Welding Code - Reinforcing Steel; 2018.

P. IAS AC89 - Accreditation Criteria for Testing Laboratories; 2018.

Q. IAS AC291 - Accreditation Criteria for Special Inspection Agencies; 2017.

R. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

S. ICC (IBC)-2018 - International Building Code; 2018.

T. SDI (QA/QC) - Standard for Quality Control and Quality Assurance for Installation of Steel Deck; 2017.

U. SJI 100 - Catalog of Standard Specifications Load Tables and Weight Tables for Steel Joists and Joist Girders; 2011.

V. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.

1.06 SPECIAL INSPECTION AGENCY

A. Owner / Library or Architect will employ services of a Special Inspection Agency to perform inspections and associated testing and sampling in accordance with ASTM E329 and required by the building code.

B. The Special Inspection Agency may employ and pay for services of an independent testing agency to perform testing and sampling associated with special inspections and required by the building code.

C. Employment of agency in no way relieves Contractor of obligation to perform work in accordance with requirements of Contract Documents.

1.07 TESTING AND INSPECTION AGENCIES

A. Owner / Library or Architect may employ services of an independent testing agency to perform additional testing and sampling associated with special inspections but not required by the building code.

B. Employment of agency in no way relieves Contractor of obligation to perform work in accordance with requirements of Contract Documents.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 SCHEDULE OF SPECIAL INSPECTIONS, GENERAL

A. Frequency of Special Inspections: Special Inspections are indicated as continuous or periodic.
   1. Continuous Special Inspection: Special Inspection Agency is required to be present in the area where the work is being performed and observe the work at all times the work is in progress.
   2. Periodic Special Inspection: Special Inspection Agency is required to be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.

3.02 SPECIAL INSPECTIONS FOR STEEL CONSTRUCTION

A. Structural Steel: Comply with quality assurance inspection requirements of ICC (IBC).

B. Cold-Formed Steel Deck: Comply with quality assurance inspection requirements of SDI (QA/QC).

C. Open-Web Joists and Joist Girders: Comply with requirements of ICC (IBC), Table 1705.2.3.
   1. End Connections - Welding or Bolted: Comply with requirements of SJI 100; periodic.
   2. Bridging - Horizontal or Diagonal:
      a. Standard Bridging: Comply with requirements of SJI 100; periodic.
      b. Bridging That Differs From the SJI Specifications: Periodic inspection.

D. High-Strength Bolt, Nut and Washer Material:
   1. Verify identification markings comply with ASTM standards specified in the approved contract and to AISC 360, Section A3.3; periodic.
   2. Submit manufacturer's certificates of compliance; periodic.

E. High-Strength Bolting Installation: Verify items listed below comply with AISC 360, Section M2.5.
   1. Snug tight joints; periodic.
   2. Pretensioned and slip-critical joints with matchmarking, twist-off bolt or direct tension indicator method of installation; periodic.
   3. Pretensioned and slip-critical joints without matchmarking or calibrated wrench method of installation; continuous.

F. Weld Filler Material:
   1. Verify identification markings comply with AWS standards specified in the approved Contract Documents and to AISC 360, Section A3.5; periodic.
   2. Submit manufacturer's certificates of compliance; periodic.

G. Welding:
   1. Structural Steel and Cold Formed Steel Deck:
      a. Complete and Partial Joint Penetration Groove Welds: Verify compliance with AWS D1.1/D1.1M; continuous.
      b. Multipass Fillet Welds: Verify compliance with AWS D1.1/D1.1M; continuous.
      c. Single Pass Fillet Welds Less than 5/16 inch Wide: Verify compliance with AWS D1.1/D1.1M; periodic.
      d. Plug and Slot Welds: Verify compliance with AWS D1.1/D1.1M; continuous.
      e. Single Pass Fillet Welds 5/16 inch or Greater: Verify compliance with AWS D1.1/D1.1M; continuous.
      f. Floor and Roof Deck Welds: Verify compliance with AWS D1.3/D1.3M; continuous.
   2. Reinforcing Steel: Verify items listed below comply with AWS D1.4/D1.4M and ACI 318, Section 3.5.2.
      a. Verification of weldability; periodic.
      b. Reinforcing steel resisting flexural and axial forces in intermediate and special moment frames as well as boundary elements of special structural walls of concrete and shear reinforcement; continuous.
      c. Shear reinforcement; continuous.
      d. Other reinforcing steel; periodic.

H. Steel Frame Joint Details: Verify compliance with approved Contract Documents.
   1. Details, bracing and stiffening; periodic.
   2. Member locations; periodic.
   3. Application of joint details at each connection; periodic.

3.03 SPECIAL INSPECTIONS FOR CONCRETE CONSTRUCTION

A. Reinforcing Steel, Including Prestressing of Tendons and Placement: Verify compliance with approved Contract Documents and ACI 318, Sections 3.5 and 7.1 through 7.7; periodic.

B. Reinforcing Steel Welding: Verify compliance with AWS D1.4/D1.4M and ACI 318, Section 3.5.2; periodic.

C. Anchors Cast in Concrete: Verify compliance with ACI 318, 17.8.2; periodic.

D. Bolts Installed in Concrete: Where allowable loads have been increased or where strength design is used, verify compliance with approved Contract Documents and ACI 318, Sections 8.1.3 and 21.2.8 prior to and during placement of concrete; continuous.

E. Anchors Post-Installed in Hardened Concrete: Verify compliance with ACI 318.
   1. Adhesive Anchors: Verify horizontally or upwardly-inclined orientation installations resisting sustained tension loads - Section 17.8.2.4; continuous.
   2. Other Mechanical and Adhesive Anchors: Verify as per Chapter 17.8.2; periodic.

F. Anchors Installed in Hardened Concrete: Verify compliance with ACI 318, Sections 3.8.6, 8.1.3, and 21.2.8; periodic.

G. Concrete Sampling Concurrent with Strength Test Sampling: Each time fresh concrete is sampled for strength tests, verify compliance with ASTM C172/C172M, ASTM C31/C31M and ACI 318, Sections 5.6 and 5.8 and record the following, continuous:
   1. Slump.
   2. Air content.
   3. Temperature of concrete.

H. Concrete and Shotcrete Placement: Verify application techniques comply with approved Contract Documents and ACI 318, Sections 5.9 and 5.10; continuous.

I. Specified Curing Temperature and Techniques: Verify compliance with approved Contract Documents and ACI 318, Sections 5.11 through 5.13; periodic.

J. Concrete Strength in Situ: Verify concrete strength complies with approved Contract Documents and ACI 318, Section 6.2, for the following.

K. Formwork Shape, Location and Dimensions: Verify compliance with approved Contract Documents and ACI 318, Section 6.1.1; periodic.

3.04 SPECIAL INSPECTIONS FOR MASONRY CONSTRUCTION

A. Masonry Structures Subject to Special Inspection:
   1. Empirically designed masonry, glass unit masonry and masonry veneer in structures designated as "essential facilities".
   2. Engineered masonry in structures classified as "low hazard..." and "substantial hazard to human life in the event of failure".

B. Verify each item below complies with approved Contract Documents and the applicable articles of TMS 402/602.
   1. Inspections and Approvals:
      a. Verify compliance with the required inspection provisions of the approved Contract Documents; periodic.
      b. Verify approval of submittals required by Contract Documents; periodic.
   2. Compressive Strength of Masonry: Verify compressive strength of masonry units prior to start of construction unless specifically exempted by code; periodic.
   3. Slump Flow and Visual Stability Index (VSI): Verify compliance as self consolidating grout arrives on site; continuous.
   4. Joints and Accessories: When masonry construction begins, verify:
      a. Proportions of site prepared mortar; periodic.
      b. Construction of mortar joints; periodic.
      c. Location of reinforcement, connectors, prestressing tendons, anchorages, etc; periodic.
   5. Structural Elements, Joints, Anchors, Protection: During masonry construction, verify:
      a. Size and location of structural elements; periodic.

b. Type, size and location of anchors, including anchorage of masonry to structural members, frames or other construction; periodic.
c. Size, grade and type of reinforcement, anchor bolts and prestressing tendons and anchorages; periodic.
d. Welding of reinforcing bars; continuous.

6. Grouting Preparation: Prior to grouting, verify:
   a. Grout space is clean; periodic.
   b. Correct placement of reinforcing, connectors, prestressing tendons and anchorages; periodic.
   c. Correctly proportioned site prepared grouts and prestressing grout for bonded tendons; periodic.
   d. Correctly constructed mortar joints; periodic.
7. Preparation of Grout Specimens, Mortar Specimens and Prisms: Observe preparation of specimens; periodic.

3.05 SPECIAL INSPECTIONS FOR SOILS

A. Materials and Placement: Verify each item below complies with approved construction documents and approved geotechnical report.
   1. Design bearing capacity of material below shallow foundations; periodic.
   2. Design depth of excavations and suitability of material at bottom of excavations; periodic.
   3. Materials, densities, lift thicknesses; placement and compaction of backfill: continuous.
   4. Subgrade, prior to placement of compacted fill verify proper preparation; periodic.

B. Testing: Classify and test excavated material; periodic.

3.06 SPECIAL INSPECTIONS FOR FIRE RESISTANT PENETRATIONS AND JOINTS

A. Verify penetration firestops in accordance with ASTM E2174.

B. Verify fire resistant joints in accordance with ASTM E2393.

3.07 SPECIAL INSPECTIONS FOR WIND RESISTANCE

A. Cold-Formed Steel Light Frame Construction:
   1. Field welding; periodic.
   2. Screw attachment, bolting, anchoring and other fastening of components within the main wind force-resisting system; periodic

B. Wind Resisting Components:
   1. Roof covering, roof deck, and floor framing connections; periodic.
   2. Exterior wall covering and wall connections to roof and floor diaphragms and framing; periodic.

C. Structural Observations for Wind Resistance: Visually observe structural system for general compliance with the approved Contract Documents; periodic.

3.08 SPECIAL INSPECTION AGENCY DUTIES AND RESPONSIBILITIES

A. Special Inspection Agency shall:
   1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
   2. Perform specified sampling and testing of products in accordance with specified reference standards.
   3. Ascertain compliance of materials and products with requirements of Contract Documents.
   4. Promptly notify Architect and Contractor of observed irregularities or non-compliance of work or products.
   5. Perform additional tests and inspections required by Architect.
   6. Submit reports of all tests or inspections specified.

B. Limits on Special Inspection Agency Authority:

1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
2. Agency may not approve or accept any portion of the work.
3. Agency may not assume any duties of Contractor.
4. Agency has no authority to stop the work.

C. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.

D. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.09 TESTING AGENCY DUTIES AND RESPONSIBILITIES

A. Testing Agency Duties:
1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
2. Perform specified sampling and testing of products in accordance with specified standards.
3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
4. Promptly notify Architect and Contractor of observed irregularities or non-compliance of work or products.
5. Perform additional tests and inspections required by Architect.
6. Submit reports of all tests or inspections specified.

B. Limits on Testing or Inspection Agency Authority:
1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
2. Agency may not approve or accept any portion of the work.
3. Agency may not assume any duties of Contractor.
4. Agency has no authority to stop the work.

C. On instructions by Architect, perform re-testing required because of non-compliance with specified requirements, using the same agency.

D. Contractor will pay for re-testing required because of non-compliance with specified requirements.

3.10 CONTRACTOR DUTIES AND RESPONSIBILITIES

A. Contractor Responsibilities, General:
1. Deliver to agency at designated location, adequate samples of materials for special inspections that require material verification.
2. Cooperate with agency and laboratory personnel; provide access to approved documents at project site, to the work, to manufacturers' facilities, and to fabricators' facilities.
3. Provide incidental labor and facilities:
   a. To provide access to work to be tested or inspected.
   b. To obtain and handle samples at the site or at source of Products to be tested or inspected.
   c. To facilitate tests or inspections.
   d. To provide storage and curing of test samples.
4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing or inspection services.
5. Arrange with Owner / Library's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

3.11 MANUFACTURERS' AND FABRICATORS' FIELD SERVICES

A. When specified in individual specification sections, require material suppliers, assembly fabricators, or product manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of

equipment, to test, adjust, and balance equipment as applicable, and to initiate instructions when necessary.

B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

END OF SECTION

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SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary sanitary facilities.

B. Temporary Controls: Barriers, enclosures, and fencing.

C. Security requirements.

D. Vehicular access and parking.

E. Waste removal facilities and services.

F. Field offices.

1.02 RELATED REQUIREMENTS

A. Section 01 51 00 - Temporary Utilities.

B. Section 01 52 13 - Field Offices and Sheds.

C. Section 01 55 00 - Vehicular Access and Parking.

1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.

B. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).

1.04 TEMPORARY UTILITIES - SEE SECTION 01 51 00

A. Provide and pay for all electrical power, lighting, water, heating and cooling, and ventilation required for construction purposes.

1.05 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.

B. Maintain daily in clean and sanitary condition.

1.06 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.

C. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.07 FENCING

A. Provide 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks.
   1. Install 2" galvanized top bar to all fencing.
   2. Fencing posts are not required to be installed into concrete.

B. Site Enclosure Fence: Before construction operations begin, install in such a manner that will prevent people and animals from easily entering site except by entrance gates.
   1. Provide own padlocks for gates. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.
   2. Portable panels may be utilized to allow for mobility and adjustments to the fencing as work progresses. Portable / movable fencing must be secured and stable.

3. Portable fencing units shall be used at areas of pavement and streets so as not to damage pavement surfaces

1.08 EXTERIOR ENCLOSURES

A. Provide temporary insulated weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.09 INTERIOR ENCLOSURES

A. Provide temporary partitions and ceilings as indicated to separate work areas from Owner / Library-occupied areas, to prevent penetration of dust and moisture into Owner / Library-occupied areas, and to prevent damage to existing materials and equipment.

B. Construction: Framing and reinforced polyethylene sheet materials with closed joints and sealed edges at intersections with existing surfaces:
   1. Insulated to R 30.
   2. STC rating of 35 in accordance with ASTM E90.
   3. Maximum flame spread rating of 75 in accordance with ASTM E84.

1.10 VEHICULAR ACCESS AND PARKING

A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.

B. Coordinate access and haul routes with governing authorities and Owner / Library.

C. Provide and maintain access to fire hydrants, free of obstructions.

D. Provide means of removing mud from vehicle wheels before entering streets.

E. **Provide temporary parking areas to accommodate construction personnel within construction extents**. When site space is not adequate, provide additional off-site parking. **Street parking by construction vehicles is not allowed**; street parking is for residents and library patrons only.

F. **Portions of the construction area have existing paving that will remain. The contractor is responsible for damage to the parking lot that will be used during construction. Prior to the start of construction, photo documentation will be conducted by the Cotractor related to the state of the existing parking lot. Any damage to the paving during construction will be the contractor's responsibility to repair or replace, as coordinated with the Architect and Owner.**

1.11 WASTE REMOVAL

A. See Section 01 74 19 - Construction Waste Management and Disposal, for additional requirements.

B. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.

C. Provide containers with lids. Remove trash from site periodically.

D. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.

E. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.12 FIELD OFFICES - SEE SECTION 01 52 13

A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack, and drawing display table.

B. Provide space for Project meetings, with table and chairs to accommodate 12 persons.

C. Locate offices a minimum distance of 30 feet from existing and new structures.

1.13 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.

B. Remove underground installations to a minimum depth of 2 feet. Grade site as indicated.

C. Clean and repair damage caused by installation or use of temporary work.

D. Restore existing facilities used during construction to original condition.

E. Restore new permanent facilities used during construction to specified condition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 01 51 00
TEMPORARY UTILITIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary Utilities: Provision of electricity, lighting, heat, ventilation, and water.

1.02 RELATED REQUIREMENTS

A. Section 01 50 00 - Temporary Facilities and Controls:
   1. Temporary sanitary facilities required by law.

1.03 REFERENCE STANDARDS

A. 29 CFR 1926 - U.S. Occupational Safety and Health Standards; current edition.

1.04 TEMPORARY ELECTRICITY

A. Cost: By Contractor.

B. Connect to Owner / Library's existing power service.
   1. Do not disrupt Owner / Library's need for continuous service.
   2. Exercise measures to conserve energy.
   3. Provide separate metering and reimburse Owner / Library for cost of energy used.

C. Provide temporary electric feeder from existing building electrical service at location as directed.

D. Complement existing power service capacity and characteristics as required.

E. Provide power outlets for construction operations, with branch wiring and distribution boxes located at each floor. Provide flexible power cords as required.

F. Provide main service disconnect and over-current protection at convenient location and meter.

G. Permanent convenience receptacles may not be utilized during construction.

H. Provide adequate distribution equipment, wiring, and outlets to provide single phase branch circuits for power and lighting.

1.05 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

A. Provide and maintain LED lighting as suitable for the application for construction operations in accordance with requirements of 29 CFR 1926 and authorities having jurisdiction.

B. Provide and maintain 1 watt/sq ft lighting to exterior staging and storage areas after dark for security purposes.

C. Provide and maintain 0.25 watt/sq ft LED lighting to interior work areas after dark for security purposes.

D. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.

E. Maintain lighting and provide routine repairs.

F. Permanent building lighting may be utilized during construction.

1.06 TEMPORARY HEATING

A. Cost of Energy: By Contractor.

B. Provide heating devices and heat as needed to maintain specified conditions for construction operations.

C. Maintain minimum ambient temperature of 50 degrees F in areas where construction is in progress, unless indicated otherwise in specifications.

1.07 TEMPORARY COOLING

A. Cost of Energy: By Contractor.

B. Provide cooling devices and cooling as needed to maintain specified conditions for construction operations.

C. Maintain maximum ambient temperature of 80 degrees F in areas where construction is in progress, unless indicated otherwise in specifications.

1.08 TEMPORARY VENTILATION

A. Existing ventilation equipment may not be used.

1.09 TEMPORARY WATER SERVICE

A. Cost of Water Used: By Contractor.

B. Provide and maintain suitable quality water service for construction operations at time of project mobilization.

C. Connect to existing water source.
   1. Exercise measures to conserve water.
   2. Provide separate metering and reimburse Owner / Library for cost of water used.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 52 13
FIELD OFFICES AND SHEDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary field offices for use of Contractor.

B. Maintenance and removal.

1.02 RELATED REQUIREMENTS

A. Section 01 50 00 - Temporary Facilities and Controls:

1.03 USE OF EXISTING FACILITIES

A. Existing facilities shall not be used for field offices.

PART 2 PRODUCTS

2.01 MATERIALS, EQUIPMENT, FURNISHINGS

A. Materials, Equipment, Furnishings: Serviceable, new or used, adequate for required purpose.

2.02 CONSTRUCTION

A. Portable or mobile buildings, or buildings constructed with floors raised above ground, securely fixed to foundations, with steps and landings at entrance doors.

B. Construction: Structurally sound, secure, weather tight enclosures for office. Maintain during progress of Work; remove when no longer needed.

C. Temperature Transmission Resistance of Floors, Walls, and Ceilings: Compatible with occupancy requirements.

D. Exterior Materials: Weather resistant, finished .

E. Interior Materials in Offices: Sheet type materials for walls and ceilings, prefinished or painted; resilient floors and bases.

F. Lighting for Offices: 50 fc at desk top height, exterior lighting at entrance doors.

G. Fire Extinguishers: Appropriate type fire extinguisher at each office.

2.03 ENVIRONMENTAL CONTROL

A. Heating, Cooling, and Ventilating: Automatic equipment to maintain 68 degrees F heating and 76 degrees F cooling.

2.04 CONTRACTOR OFFICE AND FACILITIES

A. Size: For Contractor's needs and to provide space for project meetings.

B. Furnishings in Meeting Area: Conference table and chairs to seat at least eight persons; racks and files for Contract Documents, submittals, and project record documents.

C. Other Furnishings: Contractor's option.

D. Contractor Option for meeting space:

1. Conference room space is available for a fee across the parking lot at 114 N Water Street (access to the library parking lot). If interested, coordinate with Reinhard Mueller at 502-744-6773 or reinhard_mueller@yahoo.com.

PART 3 EXECUTION

3.01 PREPARATION

A. Fill and grade sites for temporary structures to provide drainage away from buildings.

3.02 INSTALLATION

A. Install office spaces ready for occupancy 15 days after date fixed in Notice to Proceed.

3.03 MAINTENANCE AND CLEANING

A. Weekly janitorial services for offices; periodic cleaning and maintenance for offices.

B. Maintain approach walks free of mud, water, and snow.

3.04 REMOVAL

A. At completion of Work remove buildings, foundations, utility services, and debris. Restore areas.

END OF SECTION

SECTION 01 57 19
TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Construction procedures to promote adequate indoor air quality after construction.

1.02 PROJECT GOALS

A. Dust and Airborne Particulates: Prevent deposition of dust and other particulates in HVAC ducts and equipment.
   1. Cleaning of ductwork is not contemplated under this Contract.
   2. Contractor shall bear the cost of cleaning required due to failure to protect ducts and equipment from construction dust.

B. Airborne Contaminants: Procedures and products have been specified to minimize indoor air pollutants.
   1. Furnish products meeting the specifications.
   2. Avoid construction practices that could result in contamination of installed products leading to indoor air pollution.

1.03 REFERENCE STANDARDS

A. SMACNA (OCC) - IAQ Guidelines for Occupied Buildings Under Construction; 2007.

1.04 DEFINITIONS

A. Adsorptive Materials: Gypsum board, acoustical ceiling tile and panels, carpet and carpet tile, fabrics, fibrous insulation, and other similar products.

B. Contaminants: Gases, vapors, regulated pollutants, airborne mold and mildew, and the like, as specified.

C. Particulates: Dust, dirt, and other airborne solid matter.

D. Wet Work: Concrete, plaster, coatings, and other products that emit water vapor or volatile organic compounds during installation, drying, or curing.

PART 3 EXECUTION

2.01 CONSTRUCTION PROCEDURES

A. Prevent the absorption of moisture and humidity by adsorptive materials by:
   1. Sequencing the delivery of such materials so that they are not present in the building until wet work is completed and dry.
   2. Delivery and storage of such materials in fully sealed moisture-impermeable packaging.
   3. Provide sufficient ventilation for drying within reasonable time frame.

B. Begin construction ventilation when building is substantially enclosed.

C. Use of HVAC equipment and ductwork for ventilation during construction is not permitted:
   1. Provide temporary ventilation equivalent to 1.5 air changes per hour, minimum.
   2. Exhaust directly to outside.
   3. Seal HVAC air inlets and outlets immediately after duct installation.

D. Do not store construction materials or waste in mechanical or electrical rooms.

E. Do not perform dusty or dirty work after starting use of return air ducts without intake filters.

F. Use other relevant recommendations of SMACNA (OCC) for avoiding unnecessary contamination due to construction procedures.

END OF SECTION

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SECTION 01 58 13
TEMPORARY PROJECT SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project identification sign.

B. Project informational signs.

1.02 QUALITY ASSURANCE

A. Design sign and structure to withstand 50 miles/hr wind velocity.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Shop Drawing: Show content, layout, lettering, color, foundation, structure, sizes and grades of members.

PART 2 PRODUCTS

2.01 SIGN MATERIALS

A. Rough Hardware: Galvanized.

B. Sign Surfaces, provide one of the following:
   1. Exterior grade plywood with medium density overlay, minimum 3/4 inch thick, standard large sizes to minimize joints.
   2. Exterior grade aluminum composite panel.

2.02 PROJECT IDENTIFICATION SIGN

A. One vinyl graphic sign overlay, 32 sq ft area, bottom 6 feet above ground. See drawings for elevation; graphics will be provided upon request.

B. Sign shall include verbiage as required to meet USDA RD Requirements.

2.03 PROJECT INFORMATIONAL SIGNS

A. Provide at each field office, storage shed , and directional signs to direct traffic into and within site. Relocate as Work progress requires.

B. Provide municipal traffic agency directional traffic signs to and within site.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install project identification sign within 30 days after date fixed by Notice to Proceed.

B. Erect at location of high public visibility adjacent to main entrance to site.

C. Erect supports and framing on secure foundation, rigidly braced and framed to resist wind loadings.

D. Install sign surface plumb and level, with butt joints. Anchor securely.

3.02 MAINTENANCE

A. Maintain signs and supports clean, repair deterioration and damage.

3.03 REMOVAL

A. Remove signs, framing, supports, and foundations at completion of Project and restore the area.

END OF SECTION

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SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General product requirements.

B. Re-use of existing products.

C. Transportation, handling, storage and protection.

D. Product option requirements.

E. Substitution limitations.

F. Procedures for Owner / Library-supplied products.

G. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

A. Section 01 10 00 - Summary: Lists of products to be removed from existing building.

B. Section 01 10 00 - Summary: Identification of Owner / Library-supplied products.

1.03 SUBMITTALS

A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.

1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS

A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by Contract Documents.

B. Unforeseen historic items encountered remain the property of the Owner / Library; notify Owner / Library promptly upon discovery; protect, remove, handle, and store as directed by Owner / Library.

C. Specific Products to be Reused: The reuse of certain materials and equipment already existing on the current library site is required.

1. See Section 01 10 00 for list of items required to be salvaged for reuse and relocation.

2.02 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by Contract Documents.

B. Use of products having any of the following characteristics is not permitted:

1. Containing lead, cadmium, or asbestos.

2.03 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.04 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 OWNER-SUPPLIED PRODUCTS

A. See Section 01 10 00 - Summary for identification of Owner / Library-supplied products.

B. Owner / Library's Responsibilities:
   1. Arrange for and deliver Owner / Library reviewed shop drawings, product data, and samples, to Contractor.
   2. Arrange and pay for product delivery to site.
   3. On delivery, inspect products jointly with Contractor.
   4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
   5. Arrange for manufacturers' warranties, inspections, and service.

C. Contractor's Responsibilities:
   1. Review Owner / Library reviewed shop drawings, product data, and samples.
   2. Receive and unload products at site; inspect for completeness or damage jointly with Owner / Library.
   3. Handle, store, install and finish products.
   4. Repair or replace items damaged after receipt.

3.02 TRANSPORTATION AND HANDLING

A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.

B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.

C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

D. Transport and handle products in accordance with manufacturer's instructions.

E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.

H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.03 STORAGE AND PROTECTION

A. Provide protection of stored materials and products against theft, casualty, or deterioration.

B. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 01 74 19.

C. Store and protect products in accordance with manufacturers' instructions.

D. Store with seals and labels intact and legible.

E. Arrange storage of materials and products to allow for visual inspection for the purpose of determination of quantities, amounts, and unit counts.

F. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.

G. For exterior storage of fabricated products, place on sloped supports above ground.

H. Provide off-site storage and protection when site does not permit on-site storage or protection.

I. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.

J. Comply with manufacturer's warranty conditions, if any.

K. Do not store products directly on the ground.

L. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

M. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

N. Prevent contact with material that may cause corrosion, discoloration, or staining.

O. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

P. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

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SECTION 01 70 00
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Requirements for alterations work, including selective demolition.

C. Pre-installation meetings.

D. Cutting and patching.

E. Surveying for laying out the work.

F. Cleaning and protection.

G. Starting of systems and equipment.

H. Demonstration and instruction of Owner / Library personnel.

I. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.

J. General requirements for maintenance service.

1.02 RELATED REQUIREMENTS

A. Section 01 10 00 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.

B. Section 01 30 00 - Administrative Requirements: Submittals procedures, Electronic document submittal service.

C. Section 01 40 00 - Quality Requirements: Testing and inspection procedures.

D. Section 01 50 00 - Temporary Facilities and Controls: Temporary exterior enclosures.

E. Section 01 50 00 - Temporary Facilities and Controls: Temporary interior partitions.

F. Section 01 51 00 - Temporary Utilities: Temporary heating, cooling, and ventilating facilities.

G. Section 01 78 00 - Closeout Submittals: Project record documents, operation and maintenance data, warranties, and bonds.

H. Section 01 79 00 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections

I. Section 07 84 00 - Firestopping.

1.03 REFERENCE STANDARDS

A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2022.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
   1. On request, submit documentation verifying accuracy of survey work.
   2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in compliance with Contract Documents.
   3. Submit surveys and survey logs for the project record.

C. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
   1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences. Include design drawings and calculations for bracing and shoring.
   2. Identify demolition firm and submit qualifications.

3. Include a summary of safety procedures.

D. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
1. Structural integrity of any element of Project.
2. Integrity of weather exposed or moisture resistant element.
3. Efficiency, maintenance, or safety of any operational element.
4. Visual qualities of sight exposed elements.
5. Work of Owner / Library or separate Contractor.
6. Include in request:
a. Identification of Project.
b. Location and description of affected work.
c. Necessity for cutting or alteration.
d. Description of proposed work and products to be used.
e. Effect on work of Owner / Library or separate Contractor.
f. Written permission of affected separate Contractor.
g. Date and time work will be executed.

E. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.05 QUALIFICATIONS

A. For surveying work, employ a land surveyor registered in the State in which the Project is located and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,

B. For design of temporary shoring and bracing, employ a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

1.06 PROJECT CONDITIONS

A. Use of explosives is not permitted.

B. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

C. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

D. Perform dewatering activities, as required, for the duration of the project.

E. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

F. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
1. Provide dust-proof enclosures to prevent entry of dust generated outdoors.

G. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
1. Minimize amount of bare soil exposed at one time.
2. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
3. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
4. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

H. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
1. At All Times: Excessively noisy tools and operations will not be tolerated inside the building at any time of day when the building is open to the public; excessively noisy

includes jackhammers.

2. Outdoors: Limit conduct of especially noisy exterior work to the hours of 8 am to 5 pm.

I. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.

J. Rodent Control: Provide methods, means, and facilities to prevent rodents from accessing or invading premises.

K. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.07 COORDINATION

A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

B. Notify affected utility companies and comply with their requirements.

C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

F. Coordinate completion and clean-up of work of separate sections.

G. After Owner / Library occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner / Library's activities.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means

acceptance of existing conditions.

G. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.
   1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.

3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

D. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by deconstruction. Coordinate with authorities having jurisdiction.

3.03 PREINSTALLATION MEETINGS

A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.

B. Require attendance of parties directly affecting, or affected by, work of the specific section.

C. Prepare agenda and preside at meeting:
   1. Review conditions of examination, preparation and installation procedures.
   2. Review coordination with related work.

D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner / Library, participants, and those affected by decisions made.

3.04 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.

B. Promptly notify Architect of any discrepancies discovered.

C. Contractor shall locate and protect survey control and reference points.

D. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

E. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

F. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.

G. Utilize recognized engineering survey practices.

H. Establish a minimum of two permanent bench marks on site, referenced to established control points. Record locations, with horizontal and vertical data, on project record documents.

I. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
   1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
   2. Grid or axis for structures.
   3. Building foundation, column locations, ground floor elevations.

J. Periodically verify layouts by same means.

K. Maintain a complete and accurate log of control and survey work as it progresses.

3.05 GENERAL INSTALLATION REQUIREMENTS

A. In addition to compliance with regulatory requirements, conduct construction operations in compliance with NFPA 241, including applicable recommendations in Appendix A.

B. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

C. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

D. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

E. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

F. Make neat transitions between different surfaces, maintaining texture and appearance.

3.06 ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation only.
   1. Verify that construction and utility arrangements are as indicated.
   2. Report discrepancies to Architect before disturbing existing installation.
   3. Beginning of alterations work constitutes acceptance of existing conditions.

B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.
   1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 50 00 in locations indicated on drawings.

C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
   1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
   2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.

D. Remove existing work as indicated and as required to accomplish new work.
   1. Remove items indicated on drawings.
   2. Relocate items indicated on drawings.
   3. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
   4. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.

E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
   2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
   3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
      a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
      b. Provide temporary connections as required to maintain existing systems in service.
   4. Verify that abandoned services serve only abandoned facilities.

5. Remove abandoned pipe, ducts, conduits, and equipment , including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.

F. Protect existing work to remain.
1. Prevent movement of structure; provide shoring and bracing if necessary.
2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
3. Repair adjacent construction and finishes damaged during removal work.

G. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
1. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Architect.
2. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.
3. Where a change of plane of 1/4 inch or more occurs in existing work, submit recommendation for providing a smooth transition for Architect review and request instructions.

H. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.

I. Refinish existing surfaces as indicated:
1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.

J. Clean existing systems and equipment.

K. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.

L. Do not begin new construction in alterations areas before demolition is complete.

M. Comply with all other applicable requirements of this section.

3.07 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. See Alterations article above for additional requirements.

C. Perform whatever cutting and patching is necessary to:
1. Complete the work.
2. Fit products together to integrate with other work.
3. Provide openings for penetration of mechanical, electrical, and other services.
4. Match work that has been cut to adjacent work.
5. Repair areas adjacent to cuts to required condition.
6. Repair new work damaged by subsequent work.
7. Remove samples of installed work for testing when requested.
8. Remove and replace defective and non-complying work.

D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

E. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

G. Restore work with new products in accordance with requirements of Contract Documents.

H. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 84 00, to full thickness of the penetrated element.

J. Patching:
   1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
   2. Match color, texture, and appearance.
   3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.08 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.09 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

B. Provide special protection where specified in individual specification sections.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

F. Protect work from spilled liquids. If work is exposed to spilled liquids, immediately remove protective coverings, dry out work, and replace protective coverings.

G. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

H. Prohibit traffic from landscaped areas.

I. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.10 SYSTEM STARTUP

A. Coordinate schedule for start-up of various equipment and systems.

B. Notify Architect and Owner seven days prior to start-up of each item.

C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.

D. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

E. Verify that wiring and support components for equipment are complete and tested.

F. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.

G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

H. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.11 DEMONSTRATION AND INSTRUCTION

A. See Section 01 79 00 - Demonstration and Training.

B. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner / Library's personnel in detail to explain all aspects of operation and maintenance.

C. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

3.12 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

B. Testing, adjusting, and balancing HVAC systems: See Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC.

3.13 FINAL CLEANING

A. Execute final cleaning after Substantial Completion but before making final application for payment.

B. Use cleaning materials that are nonhazardous.

C. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.

E. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

F. Clean filters of operating equipment.

G. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems.

H. Clean site; sweep paved areas, rake clean landscaped surfaces.

I. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.14 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.
   1. Provide copies to Architect and Owner / Library.

B. When the Work is approaching Substantial Completion, the Contractor shall submit a written request stating that they have inspected the Work and that it is ready for an inspection for Substantial Completion by the Architect, together with a list of items to be completed or corrected. If the Architect considers the Work to be sufficiently complete, the Architect will establish a date for the Pre-Closeout Meeting and an inspection for Substantial Completion.
   1. The Architect shall schedule and conduct a Pre-Closeout Meeting. This will be held in conjunction with a progress meeting.
   2. The Pre-Closeout Meeting shall be conducted at the site before any observations for Substantial Completion. The Architect, Contractor, Subcontractors, Owner's

Representative, and representatives of the Owner shall attend. The Architect shall review all aspects of the Project Closeout, a Project Closeout Checklist and time schedule and clarify all requirements of the Contract Documents.

3. The Architect shall administrate the Project Pre-Closeout Meeting in accordance with Specifications Section 01 3100

C. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.

D. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.

1. Submit signed Substantial Completion Request Form
2. **SUBSTANTIAL COMPLETION**
   a. Preliminary Procedures: Before requesting final observation for determining date of Substantial Completion, complete the following. List items below that are incomplete with request.
      1) Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
      2) Advise Owner of pending insurance changeover requirements.
      3) Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
      4) Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
      5) Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
      6) Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
      7) Complete startup testing of systems.
      8) Submit test/adjust/balance records.
      9) Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
      10) Advise Owner of changeover in heat and other utilities.
      11) Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
      12) Complete final cleaning requirements, including touchup painting.
      13) Complete final cleaning requirements, including seeding if required.
      14) Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
3. On receipt of request, Architect will either proceed with the review or notify Contractors of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after the review or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued. Certificate will not be prepared if items above under Preliminary Procedures have not been fully completed.
   a. Re-Observation: Request a follow up review when the Work identified in previous observations as “incomplete”, are completed or corrected.
   b. Results of completed reviews will form the basis of requirements for final completion.
4. Architect/Engineers will provide for ***one*** Review for Substantial Completion, for the entire project. If additional reviews are required due to incomplete or incorrect work by the Contractors or their Sub-Contractors, <u>the Contractor will be responsible for paying for the Architect’s/Engineer's time to perform subsequent re-observations and reviews.</u>
   a. Substantial Completion Review

1) Shall take a maximum of 8 hours for each for two persons from FEH DESIGN on one day.
2) Shall take a maximum of 4 hours for each for three persons from Henneman Engineering, Inc. on one day.
3) Shall take a maximum of 4 hours for one person from Snyder and Associates on one day.
4) Any additional time required for Substantial Completion Review will be the Contractors' responsibility for paying for the Architect's/Engineer's time. Time is not cumulative with Final Review.

5. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.
6. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.
7. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.
8. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.
9. FINAL COMPLETION
   a. Preliminary Procedures: Before requesting final review for determining final completion, complete the following:
      1) Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
      2) Submit evidence of final, continuing insurance coverage complying with insurance requirements.
      3) Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
      4) Prepare and submit Project Record Documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
      5) Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
   b. Observation: Submit a written request for final review for acceptance. On receipt of request, Architect will either proceed with review or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after observation or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
      1) Re-Observation: Request review when the Work identified in previous observations as “incomplete”, are completed or corrected.
   c. Architect/Engineers will provide for ***one*** Final Review, for the entire project. If additional reviews are required due to incomplete or incorrect work by the Contractors or their Sub-Contractors, the Contractor will be responsible for paying for the Architect’s/Engineer's time to perform subsequent re-observations and reviews.
   d. Final Completion Review
      1) Shall take a maximum of 4 hours for one person from FEH DESIGN on one day.
      2) Shall take a maximum of 2 hours for one person from Henneman Engineering, Inc. on one day.
      3) Shall take a maximum of 2 hours for one person from Snyder and Associates on one day.
      4) Any additional time required for Final Review will be the Contractors' responsibility for paying for the Architect's/Engineer's time. Time is not cumulative with Substantial Completion Review.

E. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.

F. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner / Library-occupied areas.

G. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.

H. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

3.15 MAINTENANCE

A. Provide service and maintenance of components indicated in specification sections.

B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.

C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.

E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner / Library.

END OF SECTION

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SECTION 01 74 19
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.01 WASTE MANAGEMENT REQUIREMENTS

A. Owner / Library requires that this project generate the least amount of trash and waste possible.

B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.

C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.

D. Contractor shall submit periodic Waste Disposal Reports; all landfill disposal, incineration, recycling, salvage, and reuse must be reported regardless of to whom the cost or savings accrues; use the same units of measure on all reports.

E. Methods of trash/waste disposal that are not acceptable are:
   1. Burning on the project site.
   2. Burying on the project site.
   3. Dumping or burying on other property, public or private.
   4. Other illegal dumping or burying.

F. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.02 DEFINITIONS

A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.

B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.

C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.

D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.

E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.

F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.

G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.

H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.

I. Return: To give back reusable items or unused products to vendors for credit.

J. Reuse: To reuse a construction waste material in some manner on the project site.

K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.

L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.

M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.

N. Toxic: Poisonous to humans either immediately or after a long period of exposure.

O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.

P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Waste Disposal Reports: Submit at specified intervals, with details of quantities of trash and waste, means of disposal or reuse, and costs; show both totals to date and since last report.
   1. Submit updated Report with each Application for Progress Payment; failure to submit Report will delay payment.
   2. Submit Report on a form acceptable to Owner / Library.
   3. Landfill Disposal: Include the following information:
      a. Identification of material.
      b. Amount, in tons or cubic yards, of trash/waste material from the project disposed of in landfills.
      c. State the identity of landfills, total amount of tipping fees paid to landfill, and total disposal cost.
      d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
   4. Incinerator Disposal: Include the following information:
      a. Identification of material.
      b. Amount, in tons or cubic yards, of trash/waste material from the project delivered to incinerators.
      c. State the identity of incinerators, total amount of fees paid to incinerator, and total disposal cost.
      d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
   5. Recycled and Salvaged Materials: Include the following information for each:
      a. Identification of material, including those retrieved by installer for use on other projects.
      b. Amount, in tons or cubic yards, date removed from the project site, and receiving party.
      c. Transportation cost, amount paid or received for the material, and the net total cost or savings of salvage or recycling each material.
      d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
      e. Certification by receiving party that materials will not be disposed of in landfills or by incineration.
   6. Material Reused on Project: Include the following information for each:
      a. Identification of material and how it was used in the project.
      b. Amount, in tons or cubic yards.
      c. Include weight tickets as evidence of quantity.
   7. Other Disposal Methods: Include information similar to that described above, as appropriate to disposal method.

PART 3 EXECUTION

2.01 WASTE MANAGEMENT PROCEDURES

A. See Section 01 30 00 for additional requirements for project meetings, reports, submittal procedures, and project documentation.

B. See Section 01 50 00 for additional requirements related to trash/waste collection and removal facilities and services.

C. See Section 01 60 00 for waste prevention requirements related to delivery, storage, and handling.

D. See Section 01 70 00 for trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

2.02 WASTE MANAGEMENT PLAN IMPLEMENTATION

A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.

B. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, Owner / Library, and Architect.

C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.

D. Meetings: Discuss trash/waste management goals and issues at project meetings.
   1. Prebid meeting.
   2. Preconstruction meeting.
   3. Regular job-site meetings.

E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
   1. Provide containers as required.
   2. Provide adequate space for pick-up and delivery and convenience to subcontractors.
   3. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.

F. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.

G. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.

H. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.

I. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

END OF SECTION

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SECTION 01 77 10
CLOSEOUT FORM

This Certificate is to be signed by the General Contractor and transmitted to the Architect as the request for review of Substantial completion. The intent of this certificate is to expedite closeout of the project and to help assure the Owner that the portion of the work described below is complete, complies with all regulatory requirements and can be occupied for its intended purpose.

I _____ HEREBY CERTIFY THE FOLLOWING:

(Insert Contractor Name / Company)

A. I have reviewed the Contract Documents including all modifications.
B. I have inspected the Work.
C. The Work is completed in accordance with the Contract Documents and all approved contract modifications.
D. An Occupancy Permit has been issued for this part of the project.
E. The portion of the Work ready for review for Substantial Completion is identified as follows
   ___The Entire Project (put a checkmark or X in the blank)

Contractor understands and agrees that if the Architect and/or the Engineers determine that the Work is insufficiently complete to perform the Observations, the Owner may assess the Contractor for the cost of the additional time and expense incurred by the Architect, Engineers and the Owner for additional site visits, observations and expenses. These costs will be deducted from the Contract Amount through the change order process.

_____

(Contractor Name / Company Name)

_____

(Signature)

_____

(Date)

END OF SECTION

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SECTION 01 78 00
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project Record Documents.

B. Operation and Maintenance Data.

C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

A. Section 00 72 00 - General Conditions and 00 73 00 - Supplementary Conditions: Performance bond and labor and material payment bonds, warranty, and correction of work.

B. Section 01 30 00 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

C. Section 01 70 00 - Execution and Closeout Requirements: Contract closeout procedures.

D. Individual Product Sections: Specific requirements for operation and maintenance data.

E. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

A. Project Record Documents: Submit documents to Architect within 14 calendar days after Date of Substantial Completion.

B. Operation and Maintenance Data:
   1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments. One digital copy is an acceptable alternative.
   2. For equipment, or component parts of equipment put into service during construction and operated by Owner / Library, submit completed documents within ten days after acceptance.
   3. Submit one digital copy of completed documents within 14 calendar days after Substantial Completion. This copy will be reviewed and returned, with Architect comments. Revise content of all document sets as required prior to final submission.
   4. Submit two paper sets and one digital copy of revised final documents in final form within 14 calendar days after Architect comments.

C. Warranties and Bonds:
   1. For equipment or component parts of equipment put into service during construction with Owner / Library's permission, submit documents within 10 days after acceptance.
   2. Make other submittals within 14 calendar days after Date of Substantial Completion, prior to final Application for Payment.
   3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Reviewed shop drawings, product data, and samples.

B. Ensure entries are complete and accurate, enabling future reference by Owner / Library.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
   1. Manufacturer's name and product model and number.
   2. Product substitutions or alternates utilized.
   3. Changes made by Addenda and modifications.

F. Record Drawings: Legibly mark each item to record actual construction including:
   1. Measured depths of foundations in relation to finish first floor datum.
   2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
   4. Field changes of dimension and detail.
   5. Details not on original Contract drawings.
   6. Actual equipment locations.
   7. Duct size and routing.
   8. Record information on the Work that is shown only schematically.

G. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.

H. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.

I. Mark important additional information that was either shown schematically or omitted from original Drawings.

J. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

K. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
   1. Record Prints: Organize Record Prints and newly prepared Record Drawings into a manageable ses. Bind the set with durable paper cover sheets. Include identification on cover sheets.
   2. Identification: As follows:
      a. Project name.
      b. Date.
      c. Designation "PROJECT RECORD DRAWINGS."
      d. Name of Architect.
      e. Name of Contractor.

L. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

3.02 OPERATION AND MAINTENANCE DATA

A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:
   1. Product data, with catalog number, size, composition, and color and texture designations.
   2. Information for re-ordering custom manufactured products.

B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.

D. Additional information as specified in individual product specification sections.

E. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:
   1. Description of unit or system, and component parts.
   2. Identify function, normal operating characteristics, and limiting conditions.
   3. Include performance curves, with engineering data and tests.
   4. Complete nomenclature and model number of replaceable parts.

B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.

D. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

E. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

F. Provide servicing and lubrication schedule, and list of lubricants required.

G. Include manufacturer's printed operation and maintenance instructions.

H. Include sequence of operation by controls manufacturer.

I. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

J. Provide control diagrams by controls manufacturer as installed.

K. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.

L. Include test and balancing reports.

M. Additional Requirements: As specified in individual product specification sections.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

A. Assemble operation and maintenance data into durable manuals for Owner / Library's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.

B. Provide digital and hard copies of manuals.

C. Where systems involve more than one specification section, provide separate tabbed divider for each system.

D. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

E. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

F. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.

G. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.

H. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.

I. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.

J. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

K. Arrangement of Contents: Organize each volume in parts as follows:
   1. Project Directory.
   2. Table of Contents, of all volumes, and of this volume.
   3. Operation and Maintenance Data: Arranged by system, then by product category.
      a. Source data.
      b. Operation and maintenance data.
      c. Field quality control data.
      d. Photocopies of warranties and bonds.

3.06 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner / Library's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Provide digial and hard copies, where possible.

D. Co-execute submittals when required.

E. Retain warranties and bonds until time specified for submittal.

F. Manual: Bind in commercial quality 8-1/2 by 11 inch three D side ring binders with durable plastic covers.

G. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.

H. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.

I. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

END OF SECTION

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SECTION 01 79 00
DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.01 SUMMARY

A. Demonstration of products and systems to be commissioned and where indicated in specific specification sections.

B. Training of Owner / Library personnel in operation and maintenance is required for:
   1. All software-operated systems.
   2. HVAC systems and equipment.
   3. Plumbing equipment.
   4. Electrical systems and equipment.
   5. Items specified in individual product Sections.

1.02 RELATED REQUIREMENTS

A. Section 01 78 00 - Closeout Submittals: Operation and maintenance manuals.

B. Other Specification Sections: Additional requirements for demonstration and training.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures; except:
   1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Authority.
   2. Submit one copy to the Commissioning Authority, not to be returned.
   3. Make commissioning submittals on time schedule specified by Commissioning Authority.
   4. Submittals indicated as "Draft" are intended for the use of the Commissioning Authority in preparation of overall Training Plan; submit in editable electronic format, Microsoft Word 2003 preferred.

B. Training Plan: Owner / Library will designate personnel to be trained; tailor training to needs and skill-level of attendees.
   1. Submit to Architect for transmittal to Owner / Library.
   2. Submit not less than four weeks prior to start of training.
   3. Revise and resubmit until acceptable.
   4. Provide an overall schedule showing all training sessions.
   5. Include at least the following for each training session:
      a. Identification, date, time, and duration.
      b. Description of products and/or systems to be covered.
      c. Name of firm and person conducting training; include qualifications.
      d. Intended audience, such as job description.
      e. Objectives of training and suggested methods of ensuring adequate training.
      f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
      g. Media to be used, such a slides, hand-outs, etc.
      h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.

C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
   1. Include applicable portion of O&M manuals.
   2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
   3. Provide one extra copy of each training manual to be included with operation and maintenance data.

D. Video Recordings: Submit digital video recording of each demonstration and training session for Owner / Library's subsequent use.

1. Format: DVD Disc.
2. Label each disc and container with session identification and date.

1.04 QUALITY ASSURANCE

A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
   1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
   2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner / Library.

B. Demonstration may be combined with Owner / Library personnel training if applicable.

C. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.
   2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

D. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.02 TRAINING - GENERAL

A. Conduct training on-site unless otherwise indicated.

B. Do not start training until Functional Testing is complete, unless otherwise specified or approved by the Commissioning Authority.

C. Provide training in minimum two hour segments.

D. Training schedule will be subject to availability of Owner / Library's personnel to be trained; re-schedule training sessions as required by Owner / Library; once schedule has been approved by Owner / Library failure to conduct sessions according to schedule will be cause for Owner / Library to charge Contractor for personnel "show-up" time.

E. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
   1. The location of the O&M manuals and procedures for use and preservation; backup copies.
   2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
   3. Typical uses of the O&M manuals.

F. Product- and System-Specific Training:
   1. Review the applicable O&M manuals.
   2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
   3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
   4. Provide hands-on training on all operational modes possible and preventive maintenance.
   5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.

6. Discuss common troubleshooting problems and solutions.
7. Discuss any peculiarities of equipment installation or operation.
8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
9. Review recommended tools and spare parts inventory suggestions of manufacturers.
10. Review spare parts and tools required to be furnished by Contractor.
11. Review spare parts suppliers and sources and procurement procedures.

G. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

END OF SECTION

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SECTION 02 03 42
REMOVAL AND SALVAGE OF PERIOD CONSTRUCTION MATERIALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Work includes deconstruction and salvage of identified historic items and materials and removal of rubbish and debris.

B. Specified procedures required for preservation, rehabilitation, restoration, and reconstruction treatment areas.

1.02 RELATED REQUIREMENTS

A. Section 01 10 00 - Summary: Contract descriptions, description of nonhistoric preservation alterations work, work by others, future work, occupancy conditions, use of site and premises, work sequence.

B. Section 01 35 91 - Period Treatment Procedures for general historic preservation project requirements.

C. Section 02 41 00 - Demolition: Selective demolition of nonhistoric, built site elements.

D. Section 02 41 00 - Demolition: Selective demolition of nonhistoric building elements for alteration purposes.

1.03 DEFINITIONS

A. Debris: Nonhistoric building materials and contents destroyed during demolition.

B. Deconstruction: Systematic dismantling and removal of a structure or its parts and salvage of elements and components for reuse, recycling, and retaining maximum value.

1.04 REFERENCE STANDARDS

A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2022.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Work Plan: Detailed, proposed instructions for each type of operation of procedures for accomplishment of deconstruction work, including detailed description of the methods and equipment to be used and sequence of operations. Include the following:
   1. Extent of deconstruction, removal sequences, temporary and permanent bracing and shoring, and location and construction of barricades and fences.
   2. Dust control measures.
   3. Protection of property to remain undisturbed.
   4. Ensure coordination with other work.

1.06 FIELD CONDITIONS

A. Comply with applicable requirements of NFPA 241.

B. Dust Control: Control dust resulting from removal, salvage, and demolition operations from spreading to occupied portions of the project and creating a nuisance in surrounding area. Use of water to control dust is not permitted when it will result in or create:
   1. Damage to existing building materials.
   2. Hazardous or objectionable conditions such as ice, flooding, or pollution.

C. Protection of Existing Historic Property: Before beginning removal, salvage, or demolition work, survey the site and examine the drawings and specifications to determine the extent of the work. Take necessary precautions to avoid damage to existing items to remain in place, be reused, or remain Owner / Library's property. Repair or restore to original condition items damaged by Contractor, using approved means, methods, and techniques. Replace items that cannot be successfully repaired or restored to original condition.

1. Construct and maintain shoring, bracing, and supports required as a result of cutting, removal, or demolition work
2. Ensure that structural elements are not overloaded.

D. Store materials to be salvaged or recycled daily, out of contact with the ground, under weathertight covering, in areas designated by Owner / Library, and in the manner direct by Owner / Library.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 PERIOD TREATMENT, GENERAL

A. See Section 01 35 91 for special procedure requirements related to elements and features of historical significance and value.

3.02 GENERAL PROCEDURES

A. Drawings indicating existing construction, building services, and site utilities are based on casual field observation and existing record documents only.
   1. Verify that construction, building services, and site utilities arrangements are as indicated.
   2. Report discrepancies to Architect before disturbing existing historic elements.
   3. Beginning of work constitutes acceptance of existing conditions that are apparent upon examination at that time.

B. Separate spaces in which removals and salvage operations are conducted from occupied spaces.
   1. Provide, erect, and maintain temporary dustproof partitions; see Section 01 50 00.

C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; exercise care to prevent water and humidity damage.

D. See Section 02 41 00 for selective demolition of nonhistoric elements.

3.03 ENVIRONMENTAL CONTROLS

A. Comply with federal, state, and local regulations pertaining to water, air, solid waste, recycling, chemical waste, sanitary waste, sediment, and noise pollution.

B. Protection of Natural Resources: Preserve the natural resources within the project boundaries or restore to an equivalent condition.
   1. Confine removal activities to areas defined by public roads, easements, and work area limits indicated on drawings.
      a. Temporary Construction: At the conclusion of the project, remove indications of temporary construction facilities, such as haul roads, work areas, structures, stockpiles, or waste areas.
   2. Water Resources: Comply with applicable regulations concerning direct or indirect discharge of pollutants to underground and natural surface waters.
      a. Oily Substances: Prevent oily or other hazardous substances from entering the ground, drainage areas, or local bodies of water in such quantities as to affect normal use, aesthetics, or produce a measurable ecological impact on the area.
         1) Store and service construction equipment at areas designated for collection of oil wastes.
   3. Dust Control, Air Pollution, and Odor Control: Prevent creation of dust, air pollution, and odors.
      a. Use temporary enclosures and other appropriate methods to limit dust and dirt rising and scattering in air to lowest practical level.
      b. Store volatile liquids, including fuels and solvents, in closed containers.
      c. Properly maintain equipment to reduce gaseous pollutant emissions.
   4. Noise Control: Perform removal operations to minimize noise.
      a. Repetitive, high-level impact noise will be permitted only between the hours of 7:00 a.m. and 7:00 p.m. Stay within the following time limits:

Sound Level of 70 dB: Not more than 12 minutes in any hour.

b. Provide equipment, sound-deadening devices, and take noise abatement measures that are necessary to comply with the requirements of this Contract.

3.04 ITEMS TO BE SALVAGED

A. General: Salvage elements and components to the maximum extent possible. Maintain a chain of custody of salvaged materials, including the condition of such materials before and after salvage operations.
   1. Remove furnishings, equipment, and materials not scheduled for salvage or recycling prior to initiating salvaging procedures.
   2. Remove historic items to be salvaged from the structure prior to deconstruction work.
   3. Accomplish removal of salvageable items by hand labor to the maximum extent possible.
   4. Take care not to damage historic portions of the structure scheduled to remain or items identified for salvage.

B. Wood Elements: Remove intact and salvage wood elements indicated on drawings.

C. Doors and Windows: Remove intact and salvage doors and windows indicated on drawings.

3.05 MATERIALS TO BE REMOVED

A. Remove existing nonhistoric elements as indicated and as required to allow direct access to period construction elements indicated to be restored or salvaged for reuse.
   1. Remove items indicated on drawings.

B. Services: Remove existing systems and equipment to extent indicated, including but not limited to Fire Protection, Plumbing, HVAC, Electrical, and Telecommunications elements:
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and other operational components.
   2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service switchover.
   3. Verify that abandoned services serve only abandoned facilities prior to commencing removals.
   4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stubs and tag with identification.

C. Protect existing historic elements.
   1. Prevent movement of structure; provide temporary, removable shoring and bracing if necessary.
   2. Perform cutting to accomplish removals neatly, minimizing overcutting.

3.06 MATERIALS TO BE RECYCLED

A. Recycle removed nonhistoric materials to the maximum extent possible. Remove recyclable materials by hand wherever possible.

B. Recycle items indicated on drawings.

3.07 CLEANING

A. Upon completion of work, clean dust, dirt, and debris caused by salvage and demolition operations from portions of existing structure to remain and adjacent areas. Remove and transport debris and rubbish in a manner that prevents spillage on streets or adjacent areas. Obey local regulations regarding hauling and disposal.

END OF SECTION

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SECTION 02 41 00
DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Selective demolition of building elements for alteration purposes.

1.02 RELATED REQUIREMENTS

A. Section 01 10 00 - Summary: Limitations on Contractor's use of site and premises.

B. Section 01 10 00 - Summary: Description of items to be salvaged or removed for re-use by Contractor.

C. Section 01 50 00 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

D. Section 01 60 00 - Product Requirements: Handling and storage of items removed for salvage and relocation.

E. Section 01 70 00 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.

F. Section 01 74 19 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.

G. Section 31 23 23 - Fill: Fill material for filling holes, pits, and excavations generated as a result of removal operations.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Site Plan: Showing:
   1. Areas for temporary construction and field offices.
   2. Areas for temporary and permanent placement of removed materials.

C. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
   1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences.
   2. Identify demolition firm and submit qualifications.

D. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

PART 3 EXECUTION

2.01 SCOPE

A. Remove paving and curbs as required to accomplish new work.

B. Remove other items indicated, for salvage, relocation, and recycling.

C. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill as required so that required rough grade elevations do not subside within one year after completion.

2.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
   1. Obtain required permits.
   2. Comply with applicable requirements of NFPA 241.
   3. Use of explosives is not permitted.

4. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
5. Provide, erect, and maintain temporary barriers and security devices.
6. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
7. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
8. Do not close or obstruct roadways or sidewalks without permit.
9. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
10. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.

B. Do not begin removal until receipt of notification to proceed from Owner / Library.

C. Do not begin removal until built elements to be salvaged or relocated have been removed.

D. Protect existing structures and other elements that are not to be removed.
1. Provide bracing and shoring.
2. Prevent movement or settlement of adjacent structures.
3. Stop work immediately if adjacent structures appear to be in danger.

E. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

F. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner / Library; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.

G. Perform demolition in a manner that maximizes salvage and recycling of materials.
1. Comply with requirements of Section 01 74 19 - Waste Management.
2. Dismantle existing construction and separate materials.
3. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.

H. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.

2.03 EXISTING UTILITIES

A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.

B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner / Library.

E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner / Library.

F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.

G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

H. Prepare building demolition areas by disconnecting and capping utilities outside the demolition zone; identify and mark utilities to be subsequently reconnected, in same manner as other utilities to remain.

2.04 SELECTIVE DEMOLITION FOR ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as indicated.
   2. Report discrepancies to Architect before disturbing existing installation.
   3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.

B. Separate areas in which demolition is being conducted from other areas that are still occupied.
   1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 50 00 in locations indicated on drawings.
   2. Provide sound retardant partitions of construction indicated on drawings in locations indicated on drawings.

C. Remove existing work as indicated and as required to accomplish new work.
   1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction specified. Identify deteriorated materials that are outside of the scope identified on the bid documents and coordinate potential extent of work with the Archtiect.
   2. Remove items indicated on drawings.

D. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
   2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
   3. See Section 01 10 00 for other limitations on outages and required notifications.
   4. Verify that abandoned services serve only abandoned facilities before removal.
   5. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification.

E. Protect existing work to remain.
   1. Prevent movement of structure; provide shoring and bracing if necessary.
   2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
   3. Repair adjacent construction and finishes damaged during removal work.
   4. Patch as specified for patching new work.

2.05 DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, and trash from site.

B. Remove from site all materials not to be reused on site; comply with requirements of Section 01 74 19 - Waste Management.

C. Leave site in clean condition, ready for subsequent work.

D. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

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SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete formwork.

B. Floors and slabs on grade.

C. Concrete foundation walls.

D. Concrete reinforcement.

E. Joint devices associated with concrete work.

F. Miscellaneous concrete elements, including equipment pads and flagpole bases.

G. Concrete curing.

1.02 RELATED REQUIREMENTS

A. Section 01 45 33 - Code-Required Special Inspections and Procedures: for Field Quality Control testing and inspecting requirements

B. Section 07 92 00 - Joint Sealants: Products and installation for sealants and joint fillers for saw cut joints and isolation joints in slabs.

C. Section 32 13 13 - Concrete Paving: Sidewalks, curbs and gutters.

D. Refer to Architectural and Plumbing Drawings for trench drain and floor drain items to be embedded in composite slabs and slabs-on-grade.

E. Refer to Civil Drawings for reference to other applicable specificatonis.

1.03 REFERENCE STANDARDS

A. ACI 117 - Specifications for Tolerances for Concrete Construction and Materials; 2010 (Reapproved 2015).

B. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; 1991 (Reapproved 2009).

C. ACI 301 - Specifications for Structural Concrete; 2016.

D. ACI 302.1R - Guide to Concrete Floor and Slab Construction; 2015.

E. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000 (Reapproved 2009).

F. ACI 305R - Guide to Hot Weather Concreting; 2010.

G. ACI 306R - Guide to Cold Weather Concreting; 2016.

H. ACI 308R - Guide to External Curing of Concrete; 2016.

I. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2014 (Errata 2018).

J. ACI 347R - Guide to Formwork for Concrete; 2014, with Errata (2017).

K. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2020.

L. ASTM A775/A775M - Standard Specification for Epoxy-Coated Steel Reinforcing Bars; 2019.

M. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2018.

N. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2020.

O. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50 mm] Cube Specimens); 2021.

P. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2015a.

Q. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a (Reapproved 2016).

R. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2019.

S. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2019.

T. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2019.

U. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete; 2015.

V. ASTM C1059/C1059M - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete; 2013.

W. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2017.

X. ASTM C1116/C1116M - Standard Specification for Fiber-Reinforced Concrete; 2010a (Reapproved 2015).

Y. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures; 2020.

Z. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete; 2019.

AA. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2012.

BB. ASTM C1708/C1708M - Standard Test Methods for Self-leveling Mortars Containing Hydraulic Cements; 2019.

CC. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types); 2018.

DD. ASTM D3963/D3963M - Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Steel Reinforcing Bars; 2015.

EE. ASTM E1155 - Standard Test Method for Determining F(F) Floor Flatness and F(L) Floor Levelness Numbers; 2014.

FF. ASTM E1155M - Standard Test Method for Determining F(F) Floor Flatness and F(L) Floor Levelness Numbers (Metric); 2014.

GG. ASTM E1643 - Standard Practice for Selection, Design, Installation and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs; 2018a.

HH. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2017.

II. COE CRD-C 513 - COE Specifications for Rubber Waterstops; 1974.

JJ. NSF 61 - Drinking Water System Components - Health Effects; 2019.

KK. NSF 372 - Drinking Water System Components - Lead Content; 2016.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.

C. Mix Design: Submit proposed concrete mix design.
   1. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

2. Indicate proposed mix design complies with requirements of ACI 301, Section 4 - Concrete Mixtures.
3. Indicate proposed mix design complies with requirements of ACI 318, Chapter 5 - Concrete Quality, Mixing and Placing.
4. Indicate proposed mix design complies with fiber reinforcing manufacturer's written recommendations.
5. Indicate amounts of mixing water to be withheld for later addition at Project site.

D. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

E. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
1. Location of construction joints is subject to approval of the Architect.

F. Samples: Submit samples of underslab vapor retarder to be used.

G. Test Reports: Submit report for each test or series of tests specified.

H. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.

I. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner / Library's name and registered with manufacturer.

1.05 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Material Certificates: For each of the following, signed by manufacturers:
1. Cementitious materials.
2. Admixtures.
3. Form materials and form-release agents.
4. Steel reinforcement and accessories.
5. Fiber reinforcement.
6. Waterstops.
7. Curing compounds.
8. Floor and slab treatments.
9. Bonding agents.
10. Adhesives.
11. Vapor retarders.
12. Semi-rigid joint filler.
13. Joint-filler strips.
14. Repair materials.

C. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
1. Aggregates:
a. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
b. Include service record data indicating absence of deleterious expansion of concrete due to porous aggregate resulting in trapped moisture.

D. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

E. Field quality-control reports.

F. Minutes of pre-installation conference.

1.06 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301 and ACI 318.
   1. Maintain one copy of each document on site.

B. Perform work of this section in accordance with ACI 317.

C. Follow recommendations of ACI 305R when concreting during hot weather.

D. Follow recommendations of ACI 306R when concreting during cold weather.

E. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

F. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
   1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

G. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
   1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
   2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

H. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
   1. All sand and fine and coarse aggregate to be imported and free from porous material such as, but not limited to, ironstone, coal, shale, or porous limestone.

I. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."

J. Concrete Testing Service: Owner shall engage a qualified independent testing agency to perform material evaluation tests.

K. Preinstallation conference, which is desirable for major concrete installations, helps minimize misunderstandings and reviews Project conditions that might lead to significant problems. Retain paragraph below if Work of this Section is extensive or complex enough to justify a preinstallation conference.

L. Preinstallation Conference: Conduct conference at Project site.
   1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
      a. Contractor's superintendent.
      b. Independent testing agency responsible for concrete design mixtures.
      c. Ready-mix concrete manufacturer.
      d. Concrete subcontractor.
   2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semi-rigid joint fillers, forms and form removal limitations, vapor-barrier installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Moisture Emission-Reducing Curing and Sealing Compound, Membrane-Forming: Provide warranty to cover cost of flooring delamination failures for 10 years.
   1. Include cost of repair or removal of failed flooring, remediation with a moisture vapor impermeable surface coating, and replacement of flooring with comparable flooring system.

1.09 DEFINITIONS

A. Structurally Non-Composite Wythe Connectors: Structurally non-composite wythe connectors have sufficient shear capacity to transfer the dead load of a typical fascia wythe. They are not capable of transferring shear forces due to the longitudinal bending of the panel. Typically, a non-composite wythe connector is flexible and will bend due to temperature induced forces.

PART 2 PRODUCTS

2.01 FORMWORK

A. Formwork Design and Construction: Comply with guidelines of ACI 347R to provide formwork that will produce concrete complying with tolerances of ACI 117.

B. Form Materials: Contractor's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.
   1. Form Facing for Exposed Finish Concrete: Contractor's choice of materials that will provide smooth, stain-free final appearance.
   2. At Bollards: Round Fiber Tube, Recycled Paper, Single Use. Diameter as indicated on drawings.
   3. Form Coating: Release agent that will not adversely affect concrete or interfere with application of coatings.
   4. Form Ties: Cone snap type that will leave no metal within 1-1/2 inches of concrete surface.

2.02 REINFORCEMENT MATERIALS

A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).
   1. Type: Deformed billet-steel bars.
   2. Finish: Unfinished, unless otherwise indicated.
   3. Finish: Epoxy coated in accordance with ASTM A775/A775M, unless otherwise indicated.

B. Reinforcement Accessories:
   1. Tie Wire: Annealed, minimum 16 gauge, 0.0508 inch.
   2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.
   3. Provide stainless steel, galvanized, plastic, or plastic coated steel components for placement within 1-1/2 inches of weathering surfaces.

2.03 CONCRETE MATERIALS

A. Cement: ASTM C150/C150M, Type I - Normal Portland type.
   1. Acquire cement for entire project from same source.

B. Fine and Coarse Aggregates: ASTM C33/C33M.
   1. Acquire aggregates for entire project from same source.

C. Fly Ash: ASTM C618, Class C or F.

D. Ground granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

E. Silica Fume: ASTM C1240, proportioned in accordance with ACI 211.1.

F. Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
   1. Maximum Coarse-Aggregate Size: Refer to concrete mixtures.
   2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

G. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

H. Structural Fiber Reinforcement: ASTM C1116/C1116M.
   1. Fiber Type: Alkali-resistant synthetic.
   2. Fiber Length: 2 1/4 inch, nominal.
   3. Manufacturers:
      a. Euclid Chemical Company; TUF-STRAND SF: www.euclidchemical.com/#sle.
      b. Forta Corporation; FORTA FERRO: www.forta-ferro.com/#sle.
      c. GCP Applied Technologies; STRUX 90/40: www.gcpat.com/#sle.

2.04 ADMIXTURES

A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

C. Air Entrainment Admixture: ASTM C260/C260M.

D. High Range Water Reducing and Retarding Admixture: ASTM C494/C494M Type G.

E. High Range Water Reducing Admixture: ASTM C494/C494M Type F.

F. Water Reducing and Retarding Admixture: ASTM C494/C494M Type D.

G. Accelerating Admixture: ASTM C494/C494M Type C.

H. Retarding Admixture: ASTM C494/C494M Type B.

I. Water Reducing Admixture: ASTM C494/C494M Type A.

J. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.05 ACCESSORY MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.

C. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
   1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Underslab Vapor Retarder: Sheet material complying with ASTM E1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. The use of single ply polyethylene is prohibited.
   1. Installation: Comply with ASTM E1643.

2. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations.
3. Manufacturers:
   a. Fortifiber Building Systems Group: www.fortifiber.com/#sle.
   b. ISI Building Products; Viper VaporCheck II 15-mil (Class A): www.isibp.com/#sle.
   c. Stego Industries, LLC; 15-mil: www.stegoindustries.com/#sle.
   d. W. R. Meadows, Inc; PERMINATOR Class A - 15 mils (0.38 mm): www.wrmeadows.com/#sle.

F. Non-Shrink Cementitious Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
1. Grout: Comply with ASTM C1107/C1107M.
2. Low-Slump, Dry Pack Products:
   a. Euclid Chemical Company; DRY PACK GROUT: www.euclidchemical.com/#sle.
   b. Five Star Products, Inc; Five Star Grout: www.fivestarproducts.com/#sle.
   c. L&M Construction Chemicals, Inc, a subsidiary of Laticrete International, Inc; Duragrout: www.lmcc.com/#sle.
   d. SpecChem, LLC; SC Multipurpose Grout: www.specchemllc.com/#sle.

2.06 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Traffic-bearing, cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5700 psi at 28 days when tested according to ASTM C 109/C 109M.

2.07 BONDING AND JOINTING PRODUCTS

A. Latex Bonding Agent: Non-redispersable acrylic latex, complying with ASTM C1059/C1059M, Type II.

B. Waterstops: Rubber, complying with COE CRD-C 513.
1. Configuration: As indicated on drawings.
2. Size: 6 inches by 3/8 inch thick; non-tapered

C. Waterstops: Bentonite and butyl rubber, complying with NSF 61 and NSF 372.
1. Configuration: As indicated on drawings.
2. Size: As indicated on drawings.

D. Slab Isolation Joint Filler: 1/2 inch thick, height equal to slab thickness, with removable top section that will form 1/2 inch deep sealant pocket after removal.

1. Material: ASTM D1751, cellulose fiber.

2.08 CURING MATERIALS

A. Curing Agent, Water-Cure Equivalent Type: Clear, water-based, non-film-forming, liquid-water cure replacement agent.
   1. Application: Use this product to cure and seal all slabs to receive adhesively applied flooring or roofing..
   2. Compressive Strength of Treated Concrete: Equal to or greater than strength after 28-day water cure when tested according to ASTM C39/C39M.

B. Curing and Sealing Compound, High Gloss: Liquid, membrane-forming, clear, non-yellowing acrylic; complying with ASTM C1315 Type 1 Class A.
   1. VOC Content: Ozone Transport Commission (OTC) compliant.
   2. Manufacturers:
      a. Conspec by Dayton Superior; Sealcure 1315 WB.
      b. Euclid Chemical Company (The), an RPM company; Super Diamond Clear VOX; LusterSeal WB 300.
      c. L&M Construction Chemicals, Inc.; Lumiseal WB Plus.
      d. W. R. Meadows, Inc; VOCOMP-30: www.wrmeadows.com/#sle.

C. Water: Potable, not detrimental to concrete.

2.09 CONCRETE MIX DESIGN

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
   1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
   1. Fly Ash: 25 percent.
      a. Slab-on-grade receiving Permeability-reducing cure coat to have fly ash limited to 20 percent.
   2. Ground Granulated Blast-Furnace Slag: 20 percent.
   3. Combined Fly Ash and Ground Granulated Blast-Furnace Slag: 30 percent portland cement minimum, with fly ash not exceeding 25 percent.
   4. Silica Fume: 10 percent.
   5. Combined Fly Ash and Silica Fume: 35 percent with fly ash not exceeding 25 percent and silica fume not exceeding 10 percent.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

D. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended or required by manufacturer.
   1. Use water-reducing high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
   2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
   3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
   4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

E. Fiber Reinforcement: Add to mix at rate of 4 pounds per cubic yard, or as recommended by manufacturer for specific project conditions.

2.10 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.45.
3. Slump Limit: 4 to 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture plus or minus 1 inch.
4. Air Content: Air entrainment not required.
5. Maximum Aggregate Size: 1 inch.

B. Foundation Walls: Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.50.
3. Slump Limit: 4 to 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery.
5. Maximum Aggregate Size: 3/4 inch.

C. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 5000 psi at 28 days.
2. Minimum Cementitious Materials Content: 470 lb/cu. yd.
3. Maximum Water-Cementitious Materials Ratio: 0.45.
4. Slump Limit: 4 inches, plus or minus 1 inch.
5. Air Content: Do not allow air content of trowel-finished toppings to exceed 3 percent
6. Maximum Aggregate Size: 3/4 inch.
7. Synthetic Macro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 4 lb/cu. yd.

D. Slabs-on-Grade: At locations to be polished concrete finish, Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 5000 psi at 28 days.
2. Minimum Cementitious Materials Content: 470 lb/cu. yd.
3. Maximum Water-Cementitious Materials Ratio: 0.45.
4. Slump Limit: 4 inches, plus or minus 1 inch.
5. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
6. Maximum Aggregate Size: 3/8 inch.

2.11 MIXING

A. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.

B. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M, and furnish batch ticket information.
1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

C. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.
1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

2.12 RELATED MATERIALS

A. Fiber composite connectors having the following physical properties and attributes:

1. Non-conductive, non-corrosive, fiber-composite connectors having a minimum tensile strength of 120,000 psi, minimum glass fiber content of 76% (by weight), in a thermoset vinyl-ester resin matrix.
2. Upon request, connector supplier shall provide documentation of alkali resistance of connector and long-term shear capacity of connector.
3. Coefficient of thermal expansion: 3.9x10-6 in/in/°F, nominal.
4. Central body of connector shall be provided with a flange to limit insertion depth into insulation.
5. Central body of connector shall have serrated profile to provide interference fit with pre-formed holes in the insulation so as to prevent connector from backing out of insulation after installation.
6. Thermal Conductivity: 6.9 Btu/ (°F•ft2•h) per inch of length.
7. The wythe ties comprise of a fiber-composite connector with a polymer wing that controls the position of the connector within the twist-lock retainer and provides leverage during connector installation The pre-installed twist-lock retainers provide a friction fit with the pre-formed holes in the insulation eliminating concrete flow-through while the buttons structurally support the insulation at the designed location in the forms.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.02 PREPARATION

A. Formwork: Comply with requirements of ACI 301. Design and fabricate forms to support all applied loads until concrete is cured, and for easy removal without damage to concrete.

B. Verify that forms are clean and free of rust before applying release agent.

C. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.

D. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in according to bonding agent manufacturer's instructions.
   1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.
   2. Use latex bonding agent only for non-load-bearing applications.

E. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Lap joints minimum 6 inches. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.

3.03 INSTALLING REINFORCEMENT AND OTHER EMBEDDED ITEMS

A. Fabricate and handle epoxy-coated reinforcing in accordance with ASTM D3963/D3963M.

B. Comply with requirements of ACI 301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.

C. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with concrete placement.

3.04 PLACING CONCRETE

A. Place concrete in accordance with ACI 304R.

B. Place concrete for floor slabs in accordance with ACI 302.1R.

C. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.

D. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

3.05 SLAB JOINTING

A. Locate joints as indicated on drawings.

B. Anchor joint fillers and devices to prevent movement during concrete placement.

C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.
   1. Install wherever necessary to separate slab from other building members, including columns, walls, equipment foundations, footings, stairs, manholes, sumps, and drains.

D. Load Transfer Construction and Contraction Joints: Install load transfer devices as indicated; saw cut joint at surface as indicated for contraction joints.

E. Saw Cut Contraction Joints: Saw cut joints before concrete begins to cool, within 4 to 12 hours after placing; use 3/16 inch thick blade and cut at least 1 inch deep but not less than one quarter (1/4) the depth of the slab.

3.06 FLOOR FLATNESS AND LEVELNESS TOLERANCES

A. Minimum F(F) Floor Flatness and F(L) Floor Levelness Values:
   1. Exposed to View and Foot Traffic: F(F) of 20; F(L) of 15, on-grade only.
   2. Under Thick-Bed Tile: F(F) of 20; F(L) of 15, on-grade only.
   3. Under Carpeting: F(F) of 25; F(L) of 20, on-grade only.
   4. Under Thin Resilient Flooring and Thinset Tile: F(F) of 35; F(L) of 25, on-grade only.

B. Measure F(F) Floor Flatness and F(L) Floor Levelness in accordance with ASTM E1155 (ASTM E1155M), within 48 hours after slab installation; report both composite overall values and local values for each measured section.

C. Correct the slab surface if composite overall value is less than specified and if local value is less than two-thirds of specified value or less than F(F) 13/F(L) 10.

D. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.07 CONCRETE FINISHING

A. Repair surface defects, including tie holes, immediately after removing formwork.

B. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch or more in height.

C. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/4 inch or more in height. Provide finish as follows:
   1. Smooth Rubbed Finish: Wet concrete and rub with carborundum brick or other abrasive, not more than 24 hours after form removal.

D. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
   1. Surfaces to Receive Thick Floor Coverings: "Wood float" as described in ACI 302.1R; thick floor coverings include quarry tile, ceramic tile, and Portland cement terrazzo with full bed setting system.
   2. Surfaces to Receive Thin Floor Coverings: "Steel trowel" as described in ACI 302.1R; thin floor coverings include carpeting, resilient flooring, seamless flooring, resinous matrix terrazzo, thin set quarry tile, and thin set ceramic tile.
   3. Other Surfaces to Be Left Exposed: Trowel as described in ACI 302.1R, minimizing burnish marks and other appearance defects.
   4. Fine Broom Finish:
      a. Screed concrete to an even plane, float, then power trowel the surface. Provide fine hair broom finish perpendicular to slope, free of loose particles, ridges, projections, voids and concrete droppings.
      b. Provide fine broom finish as indicated on the Drawings and at the following locations:
         1) Stoop slabs.

E. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1:100 nominal.

3.08 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

3.09 CURING AND PROTECTION

A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

C. Surfaces Not in Contact with Forms:
   1. Slabs and Floors To Receive Adhesive-Applied Flooring: Curing compounds and other surface coatings are usually considered unacceptable by flooring and adhesive manufacturers. If such materials must be used, either obtain the approval of the flooring and adhesive manufacturers prior to use or remove the surface coating after curing to flooring manufacturer's satisfaction.
   2. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than three days by water ponding, water-saturated sand, water-fog spray, or saturated burlap.
   3. Final Curing: Begin after initial curing but before surface is dry.
      a. Curing Compound: Apply in two coats at right angles, using application rate recommended by manufacturer.

3.10 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

B. Defer joint filling until concrete has aged at least **one** month(s). Do not fill joints until construction traffic has permanently ceased.

C. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

D. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.11 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.

B. Provide free access to concrete operations at project site and cooperate with appointed firm.

C. Tests of concrete and concrete materials may be performed at any time to ensure compliance with specified requirements.

D. Compressive Strength Tests: ASTM C39/C39M, for each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cubic yards or less of each class of concrete placed.

E. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.

F. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.

3.12 DEFECTIVE CONCRETE

A. Test Results: The testing agency shall report test results in writing to Architect and Contractor within 24 hours of test.

B. Defective Concrete: Concrete not complying with required lines, details, dimensions, tolerances or specified requirements.

C. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

3.13 PROTECTION

A. Do not permit traffic over unprotected concrete floor surface until fully cured.

3.14 INSULATED FOUNDATION SANDWICH WALLS

A. Sandwich Walls:
   1. Set formwork in accordance with standard assembly practices, including form ties.
   2. Before installation of the insulation sheets in the forms, tape the individual sheets together per the drawings supplied by manufacturer. Install the tape on both sides of the insulation. Apply the tape only to clean, dry surfaces.
   3. Install the insulation assembly in the form.
   4. Install wythe connectors per manufacturer's instructions.
   5. Using the notches on the fiber composite connectors, tie sufficient connectors to the structural reinforcing bars to hold the insulation in place. Alternately, the connectors can be pre-installed and the insulation system can be pre-wired to the reinforcing cage before installation in the form.
   6. Place the reinforcing for the remaining concrete layer and the ties to the connectors as needed. Verify that the insulation is properly located in the form and close the form.
   7. During concrete placement, use accepted practice for concrete mix design and placement procedures for thin wall sections. If multiple walls intersect, start the concrete placement at the insulated walls. Ensure that the concrete is placed on both sides of the insulation with a maximum differential head of approximately one foot.
   8. In installations with form-liners, maintain a positive differential head on the liner side to push the insulation and the connectors away from the liner.

END OF SECTION

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SECTION 03 35 11
CONCRETE FLOOR FINISHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Liquid densifiers and hardeners.

B. Polished concrete.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Finishing of concrete surface to tolerance; floating, troweling, and similar operations; curing.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with concrete floor placement and concrete floor curing.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's published data on each finishing product, including information on compatibility of different products and limitations.

C. Maintenance Data: Provide data on maintenance and renewal of applied finishes.

D. Warranty Documentation: Manufacturer warranty; ensure that forms have been completed in Owner / Library's name and registered with manufacturer.

1.05 MOCK-UP

A. Mock-Up Size: 10 feet square.

B. Locate where directed.

C. Mock-up may remain as part of the work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's sealed packaging, including application instructions.

1.07 FIELD CONDITIONS

A. Maintain light level equivalent to a minimum 200 W light source at 8 feet above the floor surface over each 20 foot square area of floor being finished.

B. Maintain ambient temperature of 50 degrees F minimum.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Correct defective work within a two-year period commencing on the Date of Substantial Completion.

PART 2 PRODUCTS

2.01 CONCRETE FLOOR FINISH APPLICATIONS

A. Unless otherwise indicated, all exposed concrete floors are to be finished using liquid densifier/hardener.

B. Polished Finish:
   1. Use at following locations: Makerspace and Teen area, as indicated on floor finish plans.

2.02 DENSIFIERS AND HARDENERS

A. Liquid Densifier and Hardener: Penetrating chemical compound that reacts with concrete, filling the pores and dustproofing; for application to concrete after set.

2.03 POLISHED CONCRETE SYSTEM

A. Polished Concrete System: Materials, equipment, and procedures designed and furnished by a single manufacturer to produce dense polished concrete of the specified sheen.
   1. Acceptable Systems:
      a. Euclid Chemical Company; DOUBLE DIAMOND POLISHED CONCRETE FLOOR SYSTEMS: www.euclidchemical.com/#sle.
      b. PROSOCO, Inc; Consolideck Polished Concrete System: www.prosoco.com/consolideck/#sle.
      c. W. R. Meadows, Inc; Induroshine and Bellatrix Concrete Enhancer: www.wrmeadows.com/#sle.
      d. Or Approved Equal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that floor surfaces are acceptable to receive the work of this section.

B. Verify that flaws in concrete have been patched and joints filled with methods and materials suitable for further finishes.

3.02 GENERAL

A. Apply materials in accordance with manufacturer's instructions.

3.03 COATING APPLICATION

A. Verify that surface is free of previous coatings, sealers, curing compounds, water repellents, laitance, efflorescence, fats, oils, grease, wax, soluble salts, residues from cleaning agents, and other impediments to adhesion.

B. Protect adjacent non-coated areas from drips, overflow, and overspray; immediately remove excess material.

C. Apply coatings in accordance with manufacturer's instructions, matching approved mock-ups for color, special effects, sealing and workmanship.

3.04 CONCRETE POLISHING

A. Execute using materials, equipment, and procedures specified by manufacturer, using manufacturer approved installer.
   1. Final Polished Sheen: Semigloss finish; other sheens are included as comparison to illustrate required sheen; final sheen is before addition of any sealer or coating, regardless of whether that is also specified or not.
   2. Semi-Gloss Finish: Reflecting overhead and side images from 35 to 45 feet away.

B. Polish to "Level 3" 800 Grit Finish. A minimum of 9 steps with metal bonded and resin bonded diamond abrasives will be required. Starting point of 30/40 grit metals is a recommendation; actual grit should be determined by site and slab conditions, and may be a lower grit (more coarse) than 40 grit. Number of passes with each grit should also be determined by site and slab conditions; each individual grit must be utilized to achieve maximum refinement of the slab, removing all scratches from the previous grit before beginning the next finer grit.

C. Protect finished surface as required and as recommended by manufacturer of polishing system.

END OF SECTION

SECTION 04 03 00
CONSERVATION TREATMENT FOR PERIOD MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cleaning of existing masonry surfaces.

B. Replacement of existing masonry units.

C. Repair of damaged existing masonry.

D. Raking and repointing of existing mortar joints.

1.02 RELATED REQUIREMENTS

A. Section 01 35 91 - Period Treatment Procedures for general historic preservation project requirements.

B. Section 07 92 00 - Joint Sealants.

1.03 ABBREVIATIONS AND ACRONYMS

A. NPS: National Park Service, part of U.S. Department of the Interior.

B. TPS: Technical Preservation Services, part of National Park Service.

1.04 DEFINITIONS

A. Aggregates: Sand component of mortar.

B. In situ: Masonry units and mortar remain in place and are restored without removal.

C. Patching: Use of substitute repair materials to treat damaged or deteriorated masonry units in situ.

D. Repointing: Removal of existing mortar joints to specified depth and replacement with mortar matching color, texture, and performance of original mortar, and with water vapor transmission, bond, hardness, and flexibility compatible with original mortar, tested in accordance with ASTM C1713.

E. Retooling: Chisel is used to recreate surrounding stone texture finish.

F. Wall System: Masonry structures comprised of different materials but functioning holistically; restoration and cleaning processes should take into account effects on the adjacent materials and the building as a whole.

1.05 REFERENCE STANDARDS

A. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2018.

B. ASTM C1713 - Standard Specification for Mortars for the Repair of Historic Masonry; 2017.

C. ASTM D638 - Standard Test Method for Tensile Properties of Plastics; 2022.

D. ASTM D695 - Standard Test Method for Compressive Properties of Rigid Plastics; 2015.

E. ASTM D905 - Standard Test Method for Strength Properties of Adhesive Bonds in Shear by Compression Loading; 2008 (Reapproved 2021).

F. NPS (THP) - The Secretary of The Interior's Standards For the Treatment of Historic Properties with Guidelines For Preserving, Rehabilitating, Restoring & Reconstructing Historic Buildings; 2017.

G. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.

1.06 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week prior to commencing work of this section.
   1. Require attendance of parties directly affecting work of this section.

B. Scheduling of Period Treatments: Perform cleaning and washing of masonry between the hours of 7 a.m. and 7 p.m. only.

1.07 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on cleaning compounds.

C. Repointing Schedule: Detailed schedule of areas to be repointed, including assessment of the problem areas and detailed description of repointing procedures. Include the following:
   1. Description of existing general masonry failures that contribute to mortar losses and scheduling for repairs prior to repointing.
   2. Results of analysis of existing and repair mortar types and colors.
   3. 'Before' photos of areas to be repointed.

D. Samples: Submit four samples of face brick units to show matching color, texture, and extremes of color range.

E. Manufacturer's Instructions: For cleaning materials, indicate special procedures, conditions requiring special attention.

1.08 QUALITY ASSURANCE

A. Conservation Treatment Quality Control Plan: Prior to commencing work of this section, receive written approval of plan of proposed masonry restoration and cleaning work. Include the following:
   1. Description protection of surrounding construction and landscaping.
   2. Description of sequencing, work procedures, materials, and tools proposed for each conservation treatment.
      a. Effects of weather variations on sequencing of treatments, construction schedule, and protection of completed work.
   3. Description of shoring and providing safe working environment.
   4. Description of removal of deteriorated mortar joint.
   5. Description of matching of repair material and compatibility with historic materials.
   6. Description of periodic and final cleaning of masonry surfaces.
   7. Description of masonry removal and matching procedures including, but not limited to, equipment, approach, length of time the masonry will be out of the wall, mapping removal locations, and location where masonry units will be repaired, on-site or off-site.

B. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.

C. Mortar Testing Agency Qualifications: Independent firm specializing in performing analysis of historic masonry mortar.

D. Restorer Qualifications: Company specializing in period masonry restoration with minimum five years of documented experience.
   1. Use experienced masons who have demonstrated proficiency with tools on historic structures.

1.09 MOCK-UPS

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Restore and repoint existing masonry wall defined below. Include mortar, accessories, wall openings, and flashings.
   1. Repointing Mortar Joints:
      a. Minimum Dimensions: 12 feet long; 2/3 of length for horizontal joints and 1/3 of length for vertical joints.
      b. Demonstrate cutting out mortar joints, preparation for repointing, and mixing, installing, and curing mortar.
      c. Prepare and place repointing mortar in accordance with guidance provided in NPS (THP) Preservation Brief 2.
   2. Application of Repair Materials:

a. Patching: Apply repair material on minimum two masonry units of type scheduled for repair.
   1) Demonstrate removal of previous patching and application of new patching on one masonry unit.
3. Crack Repair: Repair one crack, 24 inches long, for each indicated method.

C. Locate mock-up areas within work area indicated on the drawings.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver masonry neatly stacked and tied on pallets. Store clear of ground with adequate waterproof covering.

1.11 FIELD CONDITIONS

A. Cold and Hot Weather Requirements for Masonry Work: Comply with requirements of TMS 402/602.

PART 2 PRODUCTS

2.01 CLEANING MATERIALS

A. Cleaning Agent: Detergent type.

2.02 MORTAR MATERIALS

A. Sand: ASTM C144.

B. Mortar Mixing:
   1. General Requirements:
      a. Do not use modern additives unless permitted in writing by Architect.
      b. Match the historic mortar in color, texture, and tooling.

2.03 MASONRY UNIT MATERIALS

A. Replacement Facing Brick: Match existing historic brick color, shape, size, texture, and general appearance.
   1. Actual size: As indicated on drawings.
   2. Special shapes: Molded units as required, unless standard units can be sawn to produce equivalent effect.

2.04 STONE PATCHING MATERIALS

A. Fine-Grained Stone: Products and materials designed for mixing with stone aggregate for patching fine-grained natural stone, including granite, marble, and honed-finish limestone.

B. Patching Compound: Two-component, exterior grade, clear, tintable knife-grade gel.
   1. Cured Properties:
      a. Cohesive Tensile Strength: 313 psi minimum, tested in accordance with ASTM D638.
      b. Cohesive Compressive Strength: 313 psi minimum, tested in accordance with ASTM D695.
      c. Adhesive Shear Strength: 313 psi minimum, tested in accordance with ASTM D905.
      d. Cohesive Tensile Elongation At Break: 14.9 percent minimum, tested in accordance with ASTM D638.

2.05 ACCESSORY MATERIALS

A. Mortar Additives: Matching project's existing historic mortars including components to enhance color and texture.

B. Colorants, When Required for Exact Color Match: Nonfading, mineral oxide masonry pigment as approved by the Architect.

PART 3 EXECUTION

3.01 PERIOD TREATMENT, GENERAL

A. See Section 01 35 91 for special procedure requirements related to elements and features of historical significance and value.

3.02 EXAMINATION

A. Verify that surfaces to be cleaned and restored are ready for work of this section.

3.03 EVALUATION AND ASSESSMENT

A. Begin masonry work after evaluation and analysis of areas to be repaired are completed including, but not limited to, sampling and testing of the existing mortar to determine its composition and qualities.

B. Do not start repairs until conditions causing masonry deterioration have been identified.

C. To forestall recurrence of masonry deterioration, correct deterioration-causing conditions prior to start of the restoration work.

D. Analyze composition of existing historic bedding mortar to provide basis for matching with new mortar.

3.04 PREPARATION

A. Protect other elements from damage that may result from restoration procedures.

B. Carefully remove and store identified items located in areas to be restored including, but not limited to, fixtures, fittings, finish hardware, and accessories; reinstall upon completion of restoration work.

C. Protect nonrestoration areas from restoration areas to prevent damage.

D. Mask or cover adjacent surfaces and permanent equipment. Secure coverings without using nails and without tape that leaves residue. Do not use impervious sheeting which produces condensation.
   1. Use materials that will withstand cleaning and restoration procedures.

E. Cover existing landscaping within work areas with tarpaulins or similar covers during work periods.
   1. Provide coverings that allow plants to breathe.
   2. Remove coverings at the end of each workday. Do not cover plants with waterproof membranes for more than eight hours at a time.

F. Protect roof membrane and flashings from damage with 1/2-inch plywood laid on roof surfaces over entire work area and traffic route.

G. When using liquid cleaning methods, provide drainage devices to prevent runoff over adjacent surfaces, unless those surfaces are impervious to damage from runoff.

H. Do not allow cleaning runoff to drain into sanitary or storm sewers.

3.05 INSTALLATION

A. Do not mix or apply materials when the ambient temperature or humidity are outside of range recommended by their manufacturers.

B. Schedule conservation treatments to be carried out during appropriate environmental conditions to avoid weather-related failures.

3.06 REPAIR

A. Stone Masonry Unit Patching: Patch units indicated on drawings.

3.07 MASONRY UNIT REPLACEMENT

A. Cut out damaged and deteriorated masonry to prevent damage to adjacent materials.

B. Support structure as necessary prior to cutting out units.

C. Cut away loose or unsound, adjoining masonry as directed.

D. Mortar Mix: Color and proportion to match existing.

E. Install built-in masonry work to match and align with existing, with joints and coursing true and level, faces plumb and in line. Build-in all openings, accessories, and fittings.

3.08 REPOINTING

A. Cut out loose or disintegrated mortar in joints to minimum 1/2-inch depth or until sound mortar is reached.

B. Exercise appropriate caution to prevent damage to existing masonry.

C. When cutting is complete, remove dust and loose material with air jet.

D. Premoisten joints and apply pointing mortar. Pack tightly in maximum 1/4-inch layers. Form a smooth, compact concave joint to match existing.

E. Moist cure for 72 hours.

3.09 CLEANING

A. Remove stains, efflorescence, or other excess resulting from the work of this section. Do without delay to avoid penetration and setting.

B. Remove excess mortar, smears, and droppings as work proceeds and upon completion.

C. Clean surrounding surfaces.

END OF SECTION

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SECTION 04 20 00
UNIT MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete block.

B. Clay facing brick.

C. Mortar.

D. Reinforcement and anchorage.

E. Flashings.

F. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 04 05 11 - Masonry Mortaring and Grouting.

B. Section 05 50 00 - Metal Fabrications: Loose steel lintels.

C. Section 06 10 00 - Rough Carpentry: Nailing strips built into masonry.

D. Section 07 21 00 - Thermal Insulation: Insulation for cavity spaces.

E. Section 07 25 00 - Weather Barriers: Water-resistive barriers or air barriers applied to the exterior face of the backing sheathing or masonry.

F. Section 07 62 00 - Sheet Metal Flashing and Trim: Through-wall masonry flashings.

G. Section 07 84 00 - Firestopping: Firestopping at penetrations of fire-rated masonry and at top of fire-rated walls.

H. Section 07 92 00 - Joint Sealants: Sealing control and expansion joints.

1.03 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

B. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2022.

C. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2020.

D. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2019.

E. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement; 2016, with Editorial Revision (2018).

F. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2018a.

G. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2016a.

H. ASTM C91/C91M - Standard Specification for Masonry Cement; 2018.

I. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2018.

J. ASTM C150/C150M - Standard Specification for Portland Cement; 2022.

K. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2018.

L. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale); 2022.

M. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2019.

N. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2018.

O. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2016.

P. ASTM C1714/C1714M - Standard Specification for Preblended Dry Mortar Mix for Unit Masonry; 2016.

Q. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2017.

R. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing; 2017.

S. BIA Technical Notes No. 13 - Ceramic Glazed Brick Exterior Walls; 2017.

T. BIA Technical Notes No. 28B - Brick Veneer/Steel Stud Walls; 2005.

U. BIA Technical Notes No. 46 - Maintenance of Brick Masonry; 2017.

V. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.

C. Samples for Initial Selection:
   1. Face brick.
   2. Colored mortar.
   3. Weep holes/vents.

D. Samples for Verification: For each type and color of the following:
   1. Face brick, in the form of straps of five or more bricks.
   2. Weep holes and vents.
   3. Pigmented and colored-aggregate mortar. Make Samples using same sand and mortar ingredients to be used on Project.
   4. Accessories embedded in masonry.

E. Shop Drawings: Indicate pertinent dimensions, materials, anchorage, size and type of fasteners, and accessories for brickwork support system.

F. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

G. Maintenance Materials: Furnish the following for Owner / Library's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.

1.05 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.

B. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with minimum three years of documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.06 MOCK-UP

A. Construct a masonry wall as a mock-up panel sized 8 feet long by 6 feet high; include mortar, accessories, structural backup, wall openings, flashings (with lap joint, corner, and end dam), wall insulation, and air / vapor barrier in mock-up.

B. Locate where directed.

C. Mock-up may remain as part of the Work, if acceptable.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

A. Concrete Block: Comply with referenced standards and as follows:
   1. Size: Standard units with nominal face dimensions of 16 by 8 inches and nominal depth of 8 inches.
   2. Special Shapes: Provide non-standard blocks configured for corners.
      a. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
      b. Provide bullnose units for door openings.
   3. Load-Bearing Units: ASTM C90, normal weight.
      a. Hollow block, as indicated.
      b. Exposed Faces: Manufacturer's standard color and texture where indicated.

2.02 BRICK UNITS

A. Manufacturers:
   1. General Shale Brick; www.generalshale.com
   2. Cloud Ceramics; https://cloudceramics.com.
   3. Endicott Clay Products Co; www.endicott.com.
   4. Summit Brick Co.; www.summitbrick.com.
   5. Glen Gery Brick; www.glengery.com
   6. Yankee Hill; http://yankeehillbrick.com/
   7. Or approved equal.

B. Facing Brick: ASTM C216, Type FBS Smooth, Grade SW.
   1. Color and texture:
      a. Cloud Ceramics; Kansa Gold, Velour.
   2. Nominal size: Norman 3-5/8" x 2-1/4" x 11-5/8" to match existing building brick size.
   3. Special shapes: Molded units as required by conditions indicated, unless standard units can be sawn to produce equivalent effect.

2.03 MORTAR MATERIALS

A. Masonry Cement: ASTM C91/C91M, Type N.
   1. Colored Mortar: Premixed cement as required to match Architect's color selection from manufacturer's full range of colors.
      a. Mortar for exterior brick to be tinted to match existing.
      b. Stone mortar to be gray.
      c. Interior CMU mortar to be standard gray.

B. Portland Cement: ASTM C150/C150M, Type I; color as required to produce approved color sample.

C. Hydrated Lime: ASTM C207, Type S.

D. Mortar Aggregate: ASTM C144.

E. Grout Aggregate: ASTM C404.

F. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C979/C979M.
   1. Color(s): As selected by Architect from manufacturer's full range.
   2. Manufacturers:
      a. Davis Colors, a division of Venator Materials PLC; True Tone Mortar Colors: www.daviscolors.com.
      b. Lambert Corporation; Lambco Color: www.lambertusa.com/#sle.

c. Solomon Colors, Inc; SGS Mortar Colors: www.solomoncolors.com/#sle.

G. Water: Clean and potable.

H. Accelerating Admixture: Nonchloride type for use in cold weather.

I. Packaged Dry Material for Mortar for Unit Masonry: Premixed Portland cement, hydrated lime, and sand; complying with ASTM C1714/C1714M and capable of producing mortar of the specified strength in accordance with ASTM C270 with the addition of water only.
   1. Color: Standard gray or Red, as noted above.

2.04 REINFORCEMENT AND ANCHORAGE

A. Manufacturers:
   1. Blok-Lok Limited: www.blok-lok.com/#sle.
   2. Hohmann & Barnard, Inc: www.h-b.com/#sle.
   3. WIRE-BONDwww.wirebond.com/#sle.
   4. Or approved equal.

B. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi), deformed billet bars; uncoated.

C. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.

D. Single Wythe Joint Reinforcement: ASTM A951/A951M.
   1. Type: Ladder.
   2. Material: ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M Class 3.
   3. Size: 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not less than 5/8 inch of mortar coverage on each exposure.

E. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A 153/A 153M, Class B.
   1. Anchor plates: Not less than 0.075 inch thick, designed for fastening to structural backup through sheathing by two fasteners; provide design with legs that penetrate sheathing and insulation to provide positive anchorage.
      a. Provide design with legs that penetrate sheathing to provide positive anchorage.
   2. Wire ties: Manufacturer's standard shape, 0.1875 inch thick.
   3. Vertical adjustment: Not less than 2 inches.
   4. **Masonry anchor must be thermally broken.**

F. Masonry Veneer Anchors: Dovetail anchors where substrate-appropriate (in concrete).

2.05 FLASHINGS

A. Metal Flashing Materials:

B. Combination Non-Asphaltic Flashing Materials - Stainless Steel:
   1. Stainless Steel/Polymer Fabric Flashing: ASTM A240/A240M; 2 mil type 304 stainless steel sheet bonded on one side to one sheet of polymer fabric.
      a. Manufacturers:
         1) Illinois Products, Inc.; IPCO Stainless Steel Fabric Flashing
         2) Prosoco, Inc.; R-Guard SS ThruWall
         3) STS Coatings, Inc.; Wall Guardian Stainless Steel TWF
         4) TK Products, Inc.; TK TWF
         5) York Manufacturing, Inc; Multi-Flash SS: www.yorkmfg.com/#sle.
         6) Or approved equal.

C. Termination Bars: Stainless steel; compatible with membrane and adhesives.

D. Drip Edge: Stainless steel; angled drip with hemmed edge; compatible with membrane and adhesives.
   1. Width 3"
   2. Type 304 stainless steel - 26 ga.

3. Extend 1/2" of drip edge past exterior face of masonry. Embed remainder of drip edge in full bed of non-curing butyl sealant. Adhere thru-wall flashing on top of drip edge, keeping edge 1" from exterior face of masonry.

E. Lap Sealants and Tapes: As recommended by flashing manufacturer; compatible with membrane and adhesives.

2.06 ACCESSORIES

A. Joint Filler: Closed cell polyvinyl chloride; oversized 50 percent to joint width; self expanding; in maximum lengths available.

B. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.
   1. Partial-Height Airspace Maintenance and Drainage Material: Mesh panels, fitted between masonry ties.
      a. Manufacturers:
         1) CavClear/Archovations, Inc; CavClear Masonry Mat: www.archovations.com.
         2) Hohmann & Barnard, Inc; Mortar Trap: www.h-b.com/#sle
         3) MasonPro: ProNet DT: www.masonpro.com
         4) MortarNet Solutions: MortarNet: www.mortarnet.com
         5) Or approved equal.
      b. Height: 16-inches, building perimeter and as indicated in drawings.

C. Building Paper: ASTM D226/D226M, Type I ("No.15") asphalt felt.

D. Weeps:
   1. Type: Polyester mesh.
   2. Color(s): As selected by Architect from manufacturer's full range.
   3. Manufacturers:
      a. Blok-Lok Limited; www.blok-lok.com/#sle.
      b. CavClear/Archovations, Inc: www.cavclear.com/#sle.
      c. Hohmann & Barnard, Inc; www.h-b.com/#sle.
      d. Mortar Net Solutions; www.mortarnet.com/#sle.
      e. Or approved equal.

E. Cavity Vents:
   1. Type: Extruded propylene with honeycomb design.
   2. Color(s): As selected by Architect from manufacturer's full range.
   3. Manufacturers:
      a. Blok-Lok Limited: www.blok-lok.com/#sle.
      b. CavClear/Archovations, Inc: www.cavclear.com/#sle.
      c. Hohmann & Barnard, Inc: www.h-b.com/#sle.
      d. Mortar Net Solutions: www.mortarnet.com/#sle.
      e. Or approved equal.

F. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 PREPARATION

A. Direct and coordinate placement of metal anchors supplied for installation under other sections.

B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.03 COLD AND HOT WEATHER REQUIREMENTS

A. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.

B. Maintain materials and surrounding air temperature to maximum 90 degrees F prior to, during, and 48 hours after completion of masonry work.

3.04 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Concrete Masonry Units:
   1. Bond: Running.
   2. Coursing: One unit and one mortar joint to equal 8 inches.
   3. Mortar Joints: Concave.

D. Brick Units:
   1. Bond: Running.
   2. Coursing: Three units and three mortar joints to equal 8 inches.
   3. Mortar Joints: Concave.

3.05 PLACING AND BONDING

A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

B. Lay hollow masonry units with face shell bedding on head and bed joints.

C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

D. Remove excess mortar and mortar smears as work progresses.

E. Remove excess mortar with water repellent admixture promptly. Do not use acids, sandblasting or high pressure cleaning methods.

F. Interlock intersections and external corners.

G. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

H. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

I. Isolate masonry partitions from vertical structural framing members with a control joint as indicated.

J. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

K. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress. Maintain protection until roof membrane is ready to be installed, except at walls that extend to underside of roof deck. At these locations, maintain protection until roof deck is ready to be installed.
   1. Extend cover a minimum of 24 inches or more down both sides of walls and hold cover security in place. Cover is to protect structure bearing pocket locations, extend beyond 24 inches if needed.
      a. Cover is to be held down and secured on all sides of the masonry until permanent protection can be installed.

b. Where masonry exposes the existing building to potential water damage from infiltration, extend cover as needed to fully protect existing buidling infrastructure.
c. **Loose blocks laid on top of the cover on top of the wall is not acceptable.**

2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.

3.06 WEEPS/CAVITY VENTS

A. Install weeps in veneer and cavity walls at 24 inches on center horizontally on top of through-wall flashing above shelf angles and lintels and at bottom of walls.

B. Install cavity vents in veneer and cavity walls at 24 inches on center horizontally below shelf angles and lintels and near top of walls.

3.07 CAVITY MORTAR CONTROL

A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.

B. For cavity walls, build inner wythe ahead of outer wythe to accommodate accessories.

C. Install cavity mortar control panels continuously throughout full height of exterior masonry cavities during construction of exterior wythe, complying with manufacturer's installation instructions.
1. Verify that airspace width is no more than 3/8 inch greater than panel thickness.
2. Install horizontally between joint reinforcement.
3. Stagger end joints in adjacent rows.
4. Fit to perimeter construction and penetrations without voids.

3.08 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

A. Masonry Back-Up: Embed anchors to bond veneer at maximum 16 inches on center vertically and [16] inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.

B. Stud Back-Up: Secure veneer anchors to stud framed back-up and embed into masonry veneer at maximum 16 inches on center vertically and 16 inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.

3.09 REINFORCEMENT AND ANCHORAGES - MULTIPLE WYTHE UNIT MASONRY

A. Use individual metal ties installed in horizontal joints to bond wythes together. Provide ties spaced as indicated on drawings.

3.10 MASONRY FLASHINGS

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
1. Extend flashings full width at such interruptions and at least 6 inches, minimum, into adjacent masonry or turn up flashing ends at least 8 inches, minimum, to form watertight pan at non-masonry construction.
2. Remove or cover protrusions or sharp edges that could puncture flashings.
3. Seal lapped ends and penetrations of flashing before covering with mortar.

B. Terminate flashing up 8 inches minimum on vertical surface of backing:
1. Install vertical leg of flashing over fluid-applied or self-adhered air/vapor barriers over backing or per manufacturer’s directions.
2. Terminate vertical leg of flashing into bed joint in masonry or reglet in concrete.
3. Anchor vertical leg of flashing into backing with a termination bar and sealant.
4. Apply cap bead of sealant on top edge of self-adhered flashing.

C. Install flashing in accordance with manufacturer's instructions and BIA Technical Notes No. 7.

D. Extend metal flashings to within 1 inch of exterior face of masonry and adhere to top of stainless steel angled drip with hemmed edge.

E. Support flexible flashings across gaps and openings.

F. Lap end joints of flashings at least 8 inches, minimum, and seal watertight with flashing sealant/adhesive.

3.11 LINTELS

A. Install loose steel lintels over openings, where indicated.

B. Provide minimum bearing of 8-inches at each jamb unless otherwise indicated.

C. Install reinforced unit masonry lintels over openings where indicated; refer to structural drawings.

3.12 GROUTED COMPONENTS

A. Lap splices minimum 24 bar diameters.

B. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.

C. Place and consolidate grout fill without displacing reinforcing.

3.13 CONTROL AND EXPANSION JOINTS

A. Do not continue horizontal joint reinforcement through control or expansion joints.

B. Form control joint with a sheet building paper bond breaker fitted to one side of the hollow contour end of the block unit. Fill the resultant core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.

C. Size control joints as indicated on drawings; if not indicated, 3/4 inch wide and deep.

D. Maximum control joint spacing shall be 24-feet.

E. Form expansion joint as detailed on drawings.

3.14 BUILT-IN WORK

A. As work progresses, install built-in metal door frames and glazed frames and other items to be built into the work and furnished under other sections.

B. Install built-in items plumb, level, and true to line.

3.15 TOLERANCES

A. Maximum Variation from Alignment of Columns and walls: 1/8 inch.

B. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.

C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

D. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

F. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/8 inch, plus 1/8 inch.
   1. Do not vary from head-joint thickness of adjacent course by more than 1/8 inch.

G. Maximum Variation of Mortar Joint Thickness: Bed joint, minus 1/8 inch, plus 1/8 inch.
   1. Maximum thickness limited to 1/2 inch.
   2. Do not vary from bed-joint thickness of adjacent course by more than 1/8 inch.

H. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

I. Maximum Variation in vertical alignment of head joints: 1/4 inch in 10 feet, or 1/2 inch maximum over full height of wall.

J. Maximum Variation of vertical lines such as external corners, door jambs, reveals, expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 3/8 inch in 20 feet.

K. Maximum Variation of face alignment exposed masonry units: 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

3.16 CUTTING AND FITTING

A. Cut and fit for chases. Coordinate with other sections of work to provide correct size, shape, and location.

3.17 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.

3.18 CLEANING

A. Remove excess mortar and mortar droppings.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution.

D. Use non-metallic tools in cleaning operations.

3.19 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION

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SECTION 04 43 13
STONE MASONRY VENEER

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Anchored cut stone veneer at exterior and interior walls.

B. Metal anchors and accessories for anchored veneer.

C. Setting mortar.

1.02 RELATED REQUIREMENTS

A. Section 04 20 00 - Unit Masonry: Joint reinforcement, Ties, Anchors, and Through-wall flashing.

B. Section 07 25 00 - Weather Barriers: Water-resistive barrier over sheathing.

C. Section 07 92 00 - Joint Sealants: Sealing joints indicated to be left open for sealant.

1.03 REFERENCE STANDARDS

A. ASTM A580/A580M - Standard Specification for Stainless Steel Wire; 2018.

B. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

C. ASTM C119 - Standard Terminology Relating to Dimension Stone; 2022.

D. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2019.

E. ASTM C568/C568M - Standard Specification for Limestone Dimension Stone; 2022.

F. ASTM C1515 - Standard Guide for Cleaning of Exterior Dimension Stone, Vertical And Horizontal Surfaces, New or Existing; 2020.

G. ASTM C1528/C1528M - Standard Guide for Selection of Dimension Stone; 2020.

H. ASTM C1714/C1714M - Standard Specification for Preblended Dry Mortar Mix for Unit Masonry; 2016.

I. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on stone units, mortar, and reinforcement.

C. Samples: Submit two stone samples illustrating minimum and maximum stone sizes,color range, texture, and markings.

D. Samples: Submit mortar color samples.

E. Stone Fabricator's Qualification Statement.

F. Installer's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Stone Fabricator Qualifications: Company specializing in fabricating cut stone with minimum ten years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type required by this section, with minimum 5 years of documented experience.

C. Installer Qualifications: Natural Stone Institute (NSI) Accredited Commercial B Contractor (light commercial); www.naturalstoneinstitute.org/#sle.

1.06 MOCK-UP

A. Construct stone wall mock-up, 4 feet long by 6 feet wide; include stone anchor accessories, corner condition, and typical control joint in mock-up.

B. Locate where directed.

C. Mock-up may remain as part of the Work, if acceptable.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect stone from discoloration during storage on site.

B. Provide ventilation to prevent condensation from forming on stone.

1.08 FIELD CONDITIONS

A. Maintain materials and ambient air at minimum of 40 degrees F (5 degrees C) prior to, during, and for 48 hours after completion of work.

PART 2 PRODUCTS

2.01 STONE

A. Limestone **LS-1**: Indiana Limestone variety; complying with ASTM C568/C568M Classification II - Medium Density.
   1. Color: Buff to match existing.
   2. Grain Direction: Horizontal.
   3. Surface Finish: Machine Tooled; complying with ASTM C119 and ASTM C1528/C1528M.
   4. Dimensions: Bed depths of 3 5/8"; lengths as shown on the drawings.
      a. The design intent is to match the historic building stone size at the addition.
      b. The Discover Zone stone size shall vary. 2'-0" W x 1'-0" H, 3'-7" W x 1'-0" H, 3'-0" W x 1'-0" H as dictated by the windows and window spacing.
   5. Acceptable Producers:
      a. Indiana Limestone.
      b. or Approved Equal.

2.02 MORTAR APPLICATIONS

A. At Contractor's option, mortar may be field-mixed from packaged dry materials, made from factory premixed dry materials with addition of water only, or ready-mixed.

B. Mortar Color: Natural gray unless otherwise indicated.

C. Setting Bed Mortars: Setting bed used to adhere stone veneer units to cement board.
   1. Prepackaged/Preblended Latex Modified: ANSI A118.4 or ANSI A118.15.

2.03 MORTAR MIXES

A. Packaged Dry Material for Mortar for Unit Masonry: Premixed Portland cement, hydrated lime, and sand; complying with ASTM C1714/C1714M and capable of producing mortar of the specified strength in accordance with ASTM C270 with the addition of water only.
   1. Type: Type S.
   2. Color: Standard gray.

B. Mixing: Use mechanical batch mixer and comply with referenced standards.

2.04 ACCESSORIES - ANCHORED VENEER

A. Horizontal Joint Reinforcement: Truss type; stainless steel wire complying with ASTM A580/A580M Type 304, 3/16 inch diameter side rods with 0.1483 inch diameter cross ties.

B. Wall Ties: Formed steel wire, at least 0.148 inch diameter, stainless steel complying with ASTM A580/A580M, eye and pintle type, with provision for vertical adjustment after attachment.

C. Other Anchors in Direct Contact with Stone: ASTM A666 Type 304, stainless steel, of sizes and configurations required for support of stone and applicable superimposed loads.

D. Flashings: As specified in Section 04 20 00.

E. Weep/Cavity Vents: Polyethylene tubing.

F. Back Coating:
   1. Bituminous.

G. Cleaning Solution: Type that will not harm stone, joint materials, or adjacent surfaces.

2.05 STONE FABRICATION - ANCHORED VENEER

A. Nominal Thickness: 3 5/8 inch or as indicated on drawings for site element dimensions.

B. Nominal Face Size: 12-inch vertical dimension banding at building; see drawings for site element dimensions.

C. Fabricate for 3/8 inch beds and joints.

D. Bed and Joint Surfaces:
   1. Cut or sawn full square for full thickness of unit.

E. Backs: Sawn.

F. Slope exposed top surfaces of stone and horizontal sill surfaces for shedding water.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that support work and site conditions are ready to receive work of this section.

B. Verify that substrates to receive mortar scratch coat or setting bed comply with stone veneer manufacturer's instructions.
   1. Metal Lath and Accessories: Verify lath is flat, secured to substrate, and joint and surface perimeter accessories are in place.

C. Verify that items built-in under other sections are properly located and sized.

3.02 PREPARATION - ANCHORED VENEER

A. Establish lines, levels, and coursing. Protect from disturbance.

B. Clean stone prior to installation. Do not use wire brushes or implements that mark or damage exposed surfaces.

C. Clean sawn surfaces of rust stains and iron particles.

D. Coat back surfaces not to be in contact with setting mortar with back coating material. Allow coating to cure.

3.03 INSTALLATION - ANCHORED VENEER

A. Install flashings of longest practical length and seal watertight to back-up. Lap end joints minimum 6 inches and seal watertight.

B. Size stone units to fit opening dimensions and perimeter conditions.

C. Arrange stone pattern to provide color uniformity and minimize visual variations , and provide a uniform blend of stone unit sizes.

D. Arrange stone coursing in running bond with consistent joint width.

E. Set stone in full mortar setting bed to fully support stone over bearing surface. Use setting buttons or shims to maintain correct joint width.

F. Install weep/cavity vents in vertical stone joints at 24 inches on center horizontally; immediately above horizontal flashings, above shelf angles and supports, and at top of each cavity space; do not permit mortar accumulation in cavity space.

3.04 REINFORCEMENT AND ANCHORAGE - ANCHORED VENEER

A. Install horizontal joint reinforcement 16 inches on center.

B. Place horizontal joint reinforcement in first and secondhorizontal joints above and below openings. Extend minimum 16 inches each side of opening.

C. Place joint reinforcement continuous in first and second joint below top of walls.

D. Lap joint reinforcement ends minimum 6 inches.

E. In addition, place wall ties at maximum 3 inches on center each way around perimeter of openings, within 12 inches of openings.

3.05 JOINTS - ANCHORED VENEER

A. Leave the following joints open for sealant specified in Section 07 92 00:
   1. Head joints in top courses, including copings, parapets, cornices, sills, and steps.
   2. Joints in projecting units.
   3. Joints between rigidly anchored units, including soffits, panels, and column covers.
   4. Joints below lugged sills and stair treads.
   5. Joints below ledge and relieving angles.
   6. Joints labeled "expansion joint".

B. Rake out mortar joints 5/8 to 3/4 inch and brush joints clean to accommodate pointing mortar. Fill joints with pointing mortar.

C. Pack mortar into joints and work into voids. Neatly tool surface to concave joint.

D. At joints to be sealed, clean mortar out of joint before it sets. Brush joints clean.

3.06 INSTALLATION - WATER-RESISTIVE BARRIER

A. Where required by thin stone veneer fabricator's instructions or by local codes, install two layers of water-resistive barrier in accordance with water-resistive barrier manufacturer's instructions. Integrate water-resistive barrier with all flashing accessories, adjacent water-resistive barriers, doors, windows, penetrations, and cladding transitions.

B. Lap water-resistive barrier minimum 16 inches past the corner in both directions at inside and outside corners.

C. In two layer applications, start with two horizontal layers at bottom of exterior wall or structure.

3.07 INSTALLATION - MASONRY FLASHINGS

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.

B. Extend metal flashings through exterior face of stone and terminate in an angled drip with hemmed edge.

C. Lap end joints of flashings at least 6 inches, minimum, and seal watertight with flashing sealant/adhesive.

3.08 CONTROL AND EXPANSION JOINTS

A. Form joints as detailed on drawings.

3.09 TOLERANCES

A. Install masonry within the site tolerances found in TMS 402/602.

B. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.

C. Maximum Variation from Plane of Wall: 1/4 inch in 10 feet or more.

D. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

E. Maximum Variation from Level Coursing: 1/8 inch in 3 feet and 1/4 inch in 10 feet; 1/2 inch in 30 feet.

3.10 CLEANING

A. Remove excess mortar as work progresses, and upon completion of work.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution.

D. Clean exterior stone per ASTM C1515.

E. Use non-metallic tools in cleaning operations.

3.11 PROTECTION

A. During temporary storage on site, at the end of working day, and during rainy weather, cover stone work exposed to weather with non-staining waterproof coverings, securely anchored.

END OF SECTION

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SECTION 04 72 00
CAST STONE MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Architectural cast stone.

B. Units required are:
   1. Exterior wall units, including wall caps, coping, and sills.
   2. Other items indicated on drawings.

1.02 RELATED REQUIREMENTS

A. Section 04 05 11 - Masonry Mortaring and Grouting: Mortar for setting cast stone.

B. Section 04 20 00 - Unit Masonry: Installation of cast stone in conjunction with masonry.

C. Section 07 92 00 - Joint Sealants: Sealing joints indicated to be left open for sealant.

1.03 REFERENCE STANDARDS

A. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2014 (Errata 2018).

B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

C. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2020.

D. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement; 2019.

E. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement; 2019, with Editorial Revision (2020).

F. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2018a.

G. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2018.

H. ASTM C150/C150M - Standard Specification for Portland Cement; 2022.

I. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2019.

J. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2019.

K. ASTM C642 - Standard Test Method for Density, Absorption, and Voids in Hardened Concrete; 2021.

L. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2016.

M. ASTM C1364 - Standard Specification for Architectural Cast Stone; 2019.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Include elevations, dimensions, layouts, profiles, cross sections, reinforcement, exposed faces, arrangement of joints, anchoring methods, anchors, and piece numbers.

C. Mortar Color Selection Samples.

D. Verification Samples: Pieces of actual cast stone components not less than 6 inches square, illustrating range of color and texture to be anticipated in components furnished for the project.

E. Source Quality Control Test Reports.

F. Manufacturer's Qualification Data: Documentation showing compliance with specified requirements.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. A firm with a minimum of 5 years experience producing cast stone of types required for project.
   2. Adequate plant capacity to furnish quality, sizes, and quantity of cast stone required without delaying progress of the work.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.06 MOCK-UP

A. Provide full size cast stone components for installation in mock-up of exterior wall.

B. See Section 01 40 00 - Quality Requirements for additional requirements.

C. Approved mock-up will become standard for appearance and workmanship.

D. Mock-up may remain as part of the completed work, if acceptable.

E. Remove mock-up not incorporated into the work and dispose of debris.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver cast stone components secured to shipping pallets and protected from damage and discoloration. Protect corners from damage.

B. Number each piece individually to match shop drawings and schedule.

C. Store cast stone components and installation materials in accordance with manufacturer's instructions.

D. Store cast stone components on pallets with nonstaining, waterproof covers. Ventilate under covers to prevent condensation. Prevent contact with dirt.

E. Protect cast stone components during handling and installation to prevent chipping, cracking, or other damage.

F. Store mortar materials where contamination can be avoided.

G. Schedule and coordinate production and delivery of cast stone components with unit masonry work to optimize on-site inventory and to avoid delaying the work.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Architectural Cast Stone:
   1. Basis of Design: Edwards Cast Stone Company.
   2. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:
   3. American Artstone Co., Inc..
   4. MarcStone, LLC..

2.02 ARCHITECTURAL CAST STONE

A. Cast Stone: Architectural concrete product manufactured to simulate appearance of natural sandstone, complying with ASTM C1364.
   1. Compressive Strength: As specified in ASTM C1364; calculate strength of pieces to be field cut at 80 percent of uncut piece.
   2. Freeze-Thaw Resistance: Demonstrated by laboratory testing in accordance with ASTM C1364.
   3. Surface Texture: Fine grained texture, with no bugholes, air voids, or other surface blemishes visible from distance of 20 feet.
   4. Color: Match sample on file at Architect 's office, Edwards Cast Stone Company **18-018.**

5. For Mortar: Color to match cast stone color, as selected from manufacturer's full range.
6. Sealer - Factory Finish: Provide J25 from Dayton Superior sealer on exposed surfaces.
7. Remove cement film from exposed surfaces before packaging for shipment.

B. Shapes: Provide shapes indicated on drawings.
1. Variation from Any Dimension, Including Bow, Camber, and Twist: Maximum of plus/minus 1/8 inch or length divided by 360, whichever is greater, but not more than 1/4 inch.
2. Unless otherwise indicated on drawings, provide:
a. Wash or slope of 1:12 on exterior horizontal surfaces.
b. Drips on projecting components, wherever possible.
c. Raised fillets at back of sills and at ends to be built in.

C. Reinforcement: Provide reinforcement as required to withstand handling and structural stresses; comply with ACI 318.

2.03 MATERIALS

A. Portland Cement: ASTM C150/C150M.
1. For Mortar: Type I or II, except Type III may be used in cold weather.

B. Coarse Aggregate: ASTM C33/C33M, except for gradation; granite, quartz, or limestone.

C. Fine Aggregate: ASTM C33/C33M, except for gradation; natural or manufactured sands.

D. Pigments: ASTM C979, inorganic iron oxides; do not use carbon black.

E. Admixtures: ASTM C494/C494M.

F. Water: Potable.

G. Reinforcing Bars: ASTM A615/A615M, Grade 40 (40,000 psi), deformed bars, galvanized.
1. Galvanized in accordance with ASTM A767/A767M, Class I.

H. Steel Welded Wire Reinforcement: ASTM A1064/A1064M, galvanized or ASTM A884/A884M, epoxy coated.

I. Embedded Anchors, Dowels, and Inserts: Type 304 stainless steel, of type and size as required for conditions.

J. Shelf Angles and Similar Structural Items: Hot-dip galvanized steel per ASTM A123/A123M, of shapes and sizes as required for conditions.

K. Mortar: Portland cement-lime, as specified in Section 04 05 11 ; do not use masonry cement.

L. Cleaner: General-purpose cleaner designed for removing mortar and grout stains, efflorescence, and other construction stains from new masonry surfaces without discoloring or damaging masonry surfaces; approved for intended use by cast stone manufacturer and by cleaner manufacturer for use on cast stone and adjacent masonry materials.

2.04 SOURCE QUALITY CONTROL

A. Test compressive strength and absorption of specimens selected at random from plant production.
1. Test in accordance with ASTM C642.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine construction to receive cast stone components. Notify Architect if construction is not acceptable.

B. Do not begin installation until unacceptable conditions have been corrected.

3.02 INSTALLATION

A. Install cast stone components in conjunction with masonry, complying with requirements of Section 04 20 00.

B. Mechanically anchor cast stone units indicated; set remainder in mortar.

C. Setting:
   1. Drench cast stone components with clear, running water immediately before installation.
   2. Set units in a full bed of mortar unless otherwise indicated.
   3. Fill vertical joints with mortar.
   4. Fill dowel holes and anchor slots completely with mortar or non-shrink grout.

3.03 TOLERANCES

A. Joints: Make all joints 3/8 inch, except as otherwise detailed.
   1. Rake mortar joints 3/4 inch for pointing.
   2. Remove excess mortar from face of stone before pointing joints.
   3. Point joints with mortar in layers 3/8 inch thick and tool to a slight concave profile.
   4. Leave the following joints open for sealant:
      a. Head joints in top courses, including copings, parapets, cornices, sills, and steps.
      b. Joints in projecting units.
      c. Joints between rigidly anchored units, including soffits, panels, and column covers.
      d. Joints below lugged sills and stair treads.
      e. Joints below ledge and relieving angles.
      f. Joints labeled "expansion joint".

B. Installation Tolerances:
   1. Variation from Plumb: Not more than 1/8 inch in 10 feet or more.
   2. Variation from Level: Not more than 1/8 inch in 10 feet or 3/8 inch maximum.
   3. Variation in Joint Width: Not more than 1/8 inch in 36 inches or 1/4 of nominal joint width, whichever is less.
   4. Variation in Plane Between Adjacent Surfaces (Lipping): Not more than 1/16 inch difference between planes of adjacent units or adjacent surfaces indicated to be flush with units.

3.04 REPAIR

A. Repair chips and other surface damage noticeable when viewed in direct daylight at 20 feet.

B. Repair with matching touch-up material provided by the manufacturer and in accordance with manufacturer's instructions.

C. Repair methods and results subject to Architect 's approval.

3.05 CLEANING

A. Keep cast stone components clean as work progresses.

B. Clean completed exposed cast stone after mortar is thoroughly set and cured.
   1. Wet surfaces with water before applying cleaner.
   2. Apply cleaner to cast stone in accordance with manufacturer's instructions.
   3. Remove cleaner promptly by rinsing thoroughly with clear water.
   4. Do not use acidic cleaners.

C. See Section 01 74 19 - Construction Waste Management and Disposal, for additional requirements.

3.06 PROTECTION

A. Protect completed work from damage.

B. Clean, repair, or restore damaged or mortar-splashed work to condition of new work.

END OF SECTION

SECTION 05 12 00
STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Structural steel framing members.

B. Base plates, shear stud connectors and expansion joint plates.

C. Grouting under base plates.

1.02 RELATED REQUIREMENTS

A. Section 05 21 00 - Steel Joist Framing.

B. Section 05 31 00 - Steel Decking: Support framing for small openings in deck.

1.03 REFERENCE STANDARDS

A. AISC (MAN) - Steel Construction Manual; 2017.

B. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges; 2016.

C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2020.

E. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold Finished; 2018.

F. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

G. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

H. ASTM A242/A242M - Standard Specification for High-Strength Low-Alloy Structural Steel; 2013 (Reapproved 2018).

I. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.

J. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2021.

K. ASTM A529/A529M - Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality; 2014.

L. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts; 2015.

M. ASTM A563M - Standard Specification for Carbon and Alloy Steel Nuts (Metric); 2007 (Reapproved 2013).

N. ASTM A992/A992M - Standard Specification for Structural Steel Shapes; 2020.

O. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2018a.

P. ASTM E94/E94M - Standard Guide for Radiographic Examination Using Industrial Radiographic Film; 2017.

Q. ASTM E164 - Standard Practice for Contact Ultrasonic Testing of Weldments; 2019.

R. ASTM E165/E165M - Standard Test Method for Liquid Penetrant Examination for General Industry; 2018.

S. ASTM E709 - Standard Guide for Magnetic Particle Testing; 2015.

T. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile

Strength; 2019, with Editorial Revision (2020).

U. ASTM F436/F436M - Standard Specification for Hardened Steel Washers Inch and Metric Dimensions; 2019.

V. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.

W. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020.

X. SSPC-SP 3 - Power Tool Cleaning; 2024.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:
   1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.
   2. Connections not detailed.
   3. Indicate cambers and loads.
   4. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.

C. Fabricator Test Reports: Comply with ASTM A1011/A1011M.

D. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months.

1.05 QUALITY ASSURANCE

A. Fabricate structural steel members in accordance with AISC (MAN) "Steel Construction Manual."

B. Design connections not detailed on drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

PART 2 PRODUCTS

2.01 MATERIALS

A. Steel Angles and Plates: ASTM A36/A36M.

B. Steel W Shapes and Tees: ASTM A992/A992M.

C. Rolled Steel Structural Shapes: ASTM A992/A992M.

D. Steel Shapes, Plates, and Bars: ASTM A529/A529M high-strength, carbon-manganese structural steel, Grade 50.

E. Pipe: ASTM A53/A53M, Grade B, Finish black.

F. Structural Bolts and Nuts: Carbon steel, ASTM A307, Grade A and galvanized in compliance with ASTM A153/A153M Class C.

G. High-Strength Structural Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, with matching compatible ASTM A563 or ASTM A563M nuts and ASTM F436/F436M washers.

H. Headed Anchor Rods: ASTM A307 Grade C, plain.

I. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

J. Grout: ASTM C1107/C1107M; Non-shrink; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
   1. Minimum Compressive Strength at 48 Hours: 2,000 pounds per square inch.
   2. Minimum Compressive Strength at 28 Days: 7,000 pounds per square inch.

K. Shop and Touch-Up Primer: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

L. Touch-Up Primer for Galvanized Surfaces: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

A. Shop fabricate to greatest extent possible.

B. Fabricate connections for bolt, nut, and washer connectors.

2.03 FINISH

A. Prepare structural component surfaces in accordance with SSPC-SP 3.

B. Shop prime structural steel members. Do not prime surfaces that will be field welded, in contact with concrete, or high strength bolted.

C. Galvanize structural steel members to comply with ASTM A123/A123M. Provide minimum 1.7 oz/sq ft galvanized coating.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

3.02 ERECTION

A. Erect structural steel in compliance with AISC 303.

B. Allow for erection loads and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing.

C. Field weld components indicated on shop drawings.
   1. Provide AESS 2 welds at stairs, rails, and balusters.

D. Do not field cut or alter structural members without approval of Architect.

E. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

F. Grout solidly between column plates and bearing surfaces, complying with manufacturer's instructions for nonshrink grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees.

3.03 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.

B. Welded Connections: Visually inspect all field-welded connections and test at least 10 percent of welds using one of the following:
   1. Radiographic testing performed in accordance with ASTM E94/E94M.
   2. Ultrasonic testing performed in accordance with ASTM E164.
   3. Liquid penetrant inspection performed in accordance with ASTM E165/E165M.
   4. Magnetic particle inspection performed in accordance with ASTM E709.

END OF SECTION

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SECTION 05 21 00
STEEL JOIST FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Open web steel joists, with bridging, attached seats and anchors.

B. Loose bearing members, such as plates or angles, and anchor bolts for site placement.

C. Supplementary framing for roof openings greater than 18 inches.

1.02 RELATED REQUIREMENTS

A. Section 05 12 00 - Structural Steel Framing: Superstructure framing.

B. Section 05 50 00 - Metal Fabrications: Non-framing steel fabrications attached to joists.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

B. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold Finished; 2018.

C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

D. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.

E. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts; 2015.

F. ASTM A563M - Standard Specification for Carbon and Alloy Steel Nuts (Metric); 2007 (Reapproved 2013).

G. ASTM E94/E94M - Standard Guide for Radiographic Examination Using Industrial Radiographic Film; 2017.

H. ASTM E165/E165M - Standard Test Method for Liquid Penetrant Examination for General Industry; 2018.

I. ASTM E709 - Standard Guide for Magnetic Particle Testing; 2015.

J. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2019, with Editorial Revision (2020).

K. ASTM F436/F436M - Standard Specification for Hardened Steel Washers Inch and Metric Dimensions; 2019.

L. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2014 (Amended 2015).

M. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020.

N. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel; 2018.

O. SJI 100 - Catalog of Standard Specifications Load Tables and Weight Tables for Steel Joists and Joist Girders; 2011.

P. SJI Technical Digest No. 9 - Handling and Erection of Steel Joists and Joist Girders; 2008.

Q. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.

R. SSPC-SP 2 - Hand Tool Cleaning; 2024.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate standard designations, joist coding, configurations, sizes, spacings, cambers, locations of joists, joist leg extensions, bridging, connections, and attachments.

C. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

D. Designer's Qualification Statement.

E. Manufacturer's Qualification Statement.

F. Fabricator's Qualification Statement.

G. Erector's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Design connections not detailed on drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

B. Perform Work, including that for headers and other supplementary framing, in accordance with SJI 100 Standard Specifications Load Tables and SJI Technical Digest No. 9.

C. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and dated no more than 12 months before start of scheduled welding work.

D. Fabricator Qualifications: A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Transport, handle, store, and protect products to SJI requirements.

PART 2 PRODUCTS

2.01 MATERIALS

A. Open Web Joists: SJI Type K Joists:
   1. Provide bottom chord extensions as indicated.
   2. Minimum End Bearing on Steel Supports: Comply with referenced SJI standard.
   3. Minimum End Bearing on Concrete or Masonry Supports: Comply with referenced SJI standard.
   4. Finish: Shop primed.

B. Anchor Bolts, Nuts and Washers: ASTM A307 hot-dip galvanized per ASTM A153/A153M Class C.

C. High-Strength Structural Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, with matching compatible ASTM A563 or ASTM A563M nuts and ASTM F436/F436M washers.

D. Structural Steel For Supplementary Framing and Joist Leg Extensions: ASTM A36/A36M.

E. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

F. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.02 FINISH

A. Shop prime joists as specified.

B. Prepare surfaces to be finished in accordance with SSPC-SP 2.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions prior to beginning work.

3.02 ERECTION

A. Erect joists with correct bearing on supports.

B. Allow for erection loads. Provide sufficient temporary bracing to maintain framing safe, plumb, and in true alignment.

C. Coordinate the placement of anchors for securing loose bearing members furnished as part of the work of this section.

D. After joist alignment and installation of framing, field weld joist seats to steel bearing surfaces.

E. Install supplementary framing for floor and roof openings greater than 18 inches.

F. Do not permit erection of decking until joists are braced, bridged, and secured or until completion of erection and installation of permanent bridging and bracing.

G. Do not field cut or alter structural members without approval of joist manufacturer.

H. After erection, prime welds, damaged shop primer, damaged galvanizing, and surfaces not shop primed , except surfaces specified not to be primed.

3.03 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.

B. Welded Connections: Visually inspect all field-welded connections and test at least ten percent of welds using one of the following:
   1. Radiographic testing performed in accordance with ASTM E94/E94M.
   2. Ultrasonic testing performed in accordance with ASTM E164.
   3. Liquid penetrant inspection performed in accordance with ASTM E165/E165M.
   4. Magnetic particle inspection performed in accordance with ASTM E709.

END OF SECTION

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SECTION 05 31 00
STEEL DECKING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Acoustical roof deck.

B. Roof deck.

C. Metal form deck.

D. Supplementary framing for openings up to and including 18 inches.

E. Acoustical insulation in roof deck flutes.

1.02 RELATED REQUIREMENTS

A. Section 04 20 00 - Unit Masonry: Placement of anchors for bearing plates and angles embedded in unit masonry assemblies.

B. Section 05 12 00 - Structural Steel Framing: Support framing for openings in deck.

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.

B. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2019.

C. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2014 (Amended 2015).

D. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020.

E. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2018.

F. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel; 2018.

G. ICC-ES AC70 - Acceptance Criteria for Fasteners Power Driven into Concrete, Steel and Masonry Elements; 2016.

H. SDI (DM) - Publication No.30, Design Manual for Composite Decks, Form Decks, and Roof Decks; 2007.

I. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.

J. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittals procedures.

B. Product Data: Provide deck profile characteristics, dimensions, structural properties, and finishes.

C. Shop Drawings: Indicate deck plan, support locations, projections, openings, reinforcement, pertinent details, and accessories.

D. Certificates: Certify that products furnished meet or exceed specified requirements.

E. Submit manufacturer's installation instructions.

F. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

G. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

1.05 QUALITY ASSURANCE

A. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and AWS D1.3/D1.3M and dated no more than 12 months before start of scheduled welding work.

B. Installer Qualifications: Company specializing in performing the work of this Section with minimum 3 years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Cut plastic wrap to encourage ventilation.

B. Store deck on dry wood sleepers; slope for positive drainage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Steel Deck:
   1. Canam Steel Corporation: www.canam-steeljoists.ws.
   2. New Millennium Building Systems: www.newmill.com/#sle.
   3. Nucor-Vulcraft Group: www.vulcraft.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 STEEL DECK

A. Dovetail Acoustical Roof Deck: Non-composite type, steel sheet in dovetail profile with perforated horizontal bottom face:
   1. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 40/275, with G60/Z180 galvanized coating.
   2. Primer: Shop coat of manufacturere's standard primer paint over cleaned and phosphatized substrate.
   3. Minimum Base Metal Thickness: 18 gauge, 0.0474 inch.
   4. Nominal Height: 2 inch.
   5. Profile: Dovetail.
   6. Formed Sheet Width: 24.5 inch.
   7. Side Joints: Butted, welded.
   8. End Joints: Butted, welded.

B. Roof Deck: Non-composite type, fluted steel sheet:
   1. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 50/340, Class 1, 2, or 4, with G60/Z180 galvanized coating.
   2. Primer: Shop coat of manufacturer's standard primer paint over cleaned and phosphatized substrate.
   3. Minimum Base Metal Thickness: 20 gauge, 0.0359 inch.
   4. Nominal Height: 1-1/2 inch.
   5. Profile: Fluted; SDI WR.
   6. Formed Sheet Width: 36 inch.
   7. Side Joints: Lock seam.
   8. End Joints: Lapped, mechanically fastened.

C. Metal Form Deck: Corrugated sheet steel, with provision for ventilation of concrete:
   1. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 33/230, with G90/Z275 galvanized coating.
   2. Minimum Base Metal Thickness: 20 gauge, 0.0359 inch.
   3. Nominal Height: 1.0 inch.
   4. Side Joints: Lapped, welded.
   5. End Joints: Lapped, welded.

2.03 ACCESSORY MATERIALS

A. Welding Materials: AWS D1.1/D1.1M.

B. Fasteners: Galvanized hardened steel, self tapping.

C. Powder Actuated Mechanical Fasteners: Steel; with knurled shank and forged ballistic point. Comply with applicable requirements of ICC-ES AC70.

D. Mechanical Fasteners: Steel; hex washer head, self-drilling, self-tapping.
   1. Fasteners for Steel Roof Decks Protected with Waterproofing Membrane: ASTM B633, SC1, Type III zinc electroplate.
   2. Fasteners for Exposed Steel Roof Deck Application: Manufacturer's standard stainless steel with bonded neoprene washer.

E. Weld Washers: Mild steel, uncoated, 3/4 inch outside diameter, 1/8 inch thick.

F. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

G. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, complying with VOC limitations of authorities having jurisdiction.

H. Flute Closures: Closed cell foam rubber, 1 inch thick; profiled to fit tight to the deck.

I. Acoustical Insulation: Glass fiber type, minimum 1.1 lb/cu ft density; profiled to suit deck.

J. For dovetail deck profiles: Wedge Bolt hanging devices that are installable and relocatable along the length of the interior ribs of the roof deck panel.

K. Where dovetail deck panels continue from the interior of the building through to the exterior of the building, provide air dams to block the movement of conditioned air from the interior to exterior.

2.04 FABRICATED DECK ACCESSORIES

A. Sheet Metal Deck Accessories: Metal closure strips, wet concrete stops, and cover plates, 20 gauge, 0.0359 inch thick sheet steel; of profile and size as indicated; finished same as deck.

B. Roof Sump Pans: Formed sheet steel, 14 gauge, 0.0747 inch minimum thickness, flat bottom, sloped sides, recessed 1-1/2 inches below roof deck surface, bearing flange 3 inches wide, sealed watertight.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions prior to beginning work.

3.02 INSTALLATION

A. Erect metal deck in accordance with SDI Design Manual and manufacturer's instructions. Align and level.

B. On steel supports provide minimum 1-1/2 inch bearing at deck edge locations, and minimum 3 inch (76 mm) bearing at interior bearing locations.

C. Fasten deck to steel support members at ends and intermediate supports as indicated in the deck schedule on the drawings, parallel with the deck flute using methods indicated on drawings.
   1. Welding: Use fusion welds through weld washers.

D. Clinch lock seam side laps.

E. Drive mechanical sidelap connectors completely through adjacent lapped sheets; positively engage adjacent sheets with minimum three-thread penetration.

F. At welded male/female side laps weld as indicated in the deck schedule on the drawings.

G. Weld deck in accordance with AWS D1.3/D1.3M.

H. At all deck openings, provide steel angle reinforcement as indicated on drawings.

I. At openings between deck and walls, columns, and openings, provide sheet steel closures and angle flashings to close openings.

J. Close openings above walls and partitions perpendicular to deck flutes with single row of foam cell closures.

K. Position roof drain pans with flange bearing on top surface of deck. Fusion weld at each deck flute.

L. Immediately after welding deck and other metal components in position, coat welds, burned areas, and damaged surface coating, with touch-up primer.

END OF SECTION

SECTION 05 40 00
COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Formed steel stud exterior wall framing.

B. Formed steel joist and slotted channel framing and bridging.

1.02 RELATED REQUIREMENTS

A. Section 09 22 16 - Non-Structural Metal Framing.

1.03 REFERENCE STANDARDS

A. AISI S100-12 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2012.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.

D. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2020.

E. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's data on factory-made framing connectors, showing compliance with requirements.

C. Shop Drawings: Indicate component details, framed openings, bearing, anchorage, loading, welds, and type and location of fasteners, and accessories or items required of related work.
   1. Indicate stud and ceiling joist layout.
   2. Describe method for securing studs to tracks and for bolted framing connections.
   3. Design data:
      a. Shop drawings signed and sealed by a professional structural engineer.

D. Manufacturer's Installation Instructions: Indicate special procedures, conditions requiring special attention .

E. Manufacturer's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Design framing system under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

1.06 MOCK-UP

A. Provide mock-up of exterior framed wall, including components specified elsewhere, such as insulation, sheathing, exterior wall finish, and interior wall finish.

B. Mock-Up Size: six by six feet, including corner condition.

C. Location: As directed.

D. Mock-up may remain as part of the Work.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Framing:
   1. CEMCO: www.cemcosteel.com/#sle.

2. ClarkDietrich: www.clarkdietrich.com/#sle.
3. Marino: www.marinoware.com/#sle.
4. The Steel Network, Inc: www.SteelNetwork.com/#sle.

B. Framing Connectors and Accessories:
1. Same manufacturer as metal framing.

2.02 FRAMING SYSTEM

A. Provide primary and secondary framing members, bridging, bracing, plates, gussets, clips, fittings, reinforcement, and fastenings as required to provide a complete framing system.

B. Design Requirements: Provide completed framing system having the following characteristics:
1. Structural Performance: Design, engineer, fabricate, and erect to withstand specified design loads for project conditions within required limits.
2. Design Loads: In accordance with applicable codes.
3. Live load deflection meeting the following, unless otherwise indicated:
   a. Exterior Walls: Maximum horizontal deflection under wind load of 1/600 of span where framing backs up masonry, 1/360 elsewhere.
   b. Design non-axial loadbearing framing to accommodate not less than 1/2 in vertical deflection.
4. Able to tolerate movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.
5. Able to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

2.03 FRAMING MATERIALS

A. Studs and Track: ASTM C955; studs formed to channel, C- or Sigma-shaped with punched web; U-shaped track in matching nominal width and compatible height.
1. Gage and Depth: As required to meet specified performance levels.
2. Stud Depth: Refer to Architectural Drawings
3. Galvanized in accordance with ASTM A653/A653M, G90/Z275 coating.

B. Framing Connectors: Factory-made, formed steel sheet.
1. Material: ASTM A653/A653M SS Grade 33 and 40 (minimum), with G90/Z275 hot dipped galvanized coating for base metal thickness less than 10 gage, 0.1345 inch, and factory punched holes and slots.
2. Movement Connections: Provide mechanical anchorage devices that accommodate movement using slotted holes, shouldered screws or screws and anti-friction or stepped bushings, while maintaining structural performance of framing. Provide movement connections where indicated on drawings.
   a. Where top of stud wall terminates below structural floor or roof, connect studs to structure in manner allowing vertical and horizontal movement of slab without affecting studs; allow for minimum vertical movement of 1 inch.
3. Fixed Connections: Provide non-movement connections for tie-down to foundation, floor-to-floor tie-down, roof-to-wall tie-down, joist hangers, gusset plates, and stiffeners.
4. Wall Stud Bridging Connections: Provide mechanical load-transferring devices that accommodate wind load torsion and weak axis buckling induced by axial compression loads. Provide bridging connections where indicated on the drawings.

2.04 FASTENERS

A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot dip galvanized per ASTM A153/A153M.

B. Anchorage Devices: Powder actuated.

C. Welding: Comply with AWS D1.1/D1.1M.

2.05 ACCESSORIES

A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.

B. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Verify field measurements and adjust installation as required.

3.02 INSTALLATION OF STUDS

A. Install components in accordance with manufacturers' instructions and ASTM C1007 requirements.

B. Align floor and ceiling tracks; locate to wall layout. Secure in place with fasteners at maximum 24 inches on center. Coordinate installation of sealant with floor and ceiling tracks.

C. Construct corners using minimum of three studs. Install double studs at wall openings, door and window jambs.

D. Install load-bearing studs full length in one piece. Splicing of studs is not permitted.

E. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.

F. Install intermediate studs above and below openings to align with wall stud spacing.

G. Provide deflection allowance in stud track, directly below horizontal building framing at non-load bearing framing.

H. Attach cross studs to studs for attachment of fixtures anchored to walls.

I. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.

J. Touch-up field welds and damaged galvanized surfaces with primer.

3.03 INSTALLATION OF JOISTS AND PURLINS

A. Install framing components in accordance with manufacturer's instructions.

B. Make provisions for erection stresses. Provide temporary alignment and bracing.

C. Set floor and ceiling joists parallel and level, with lateral bracing and bridging.

D. Locate joist end bearing directly over load-bearing studs or provide load distributing member to top of stud track.

E. Provide web stiffeners at reaction points.

F. Touch-up field welds and damaged galvanized surfaces with primer.

END OF SECTION

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SECTION 05 44 00
COLD-FORMED METAL TRUSSES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Light gauge cold-formed steel roof trusses.

B. Anchorages, bracing, and bridging.

1.02 RELATED REQUIREMENTS

A. Section 05 21 00 - Steel Joist Framing: Structural steel open-web joists and joist girders.

B. Section 05 40 00 - Cold-Formed Metal Framing: Light gauge structural metal studs, joists, and rafters.

1.03 REFERENCE STANDARDS

A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2016, with Supplement (2018).

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.

C. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2009 (Reapproved 2015).

D. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020.

E. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2018.

F. CFSEI 5000 - Field Installation Guide for Cold-Formed Steel Roof Trusses; May 2000.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Span charts.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Shop Drawings:
   1. Include detailed roof truss layout.
   2. Show member type, location, spacing, size and gauge, methods of attachment, and erection details. Indicate supplemental bracing, strapping, splices, bridging, and accessories.
   3. Include truss design drawings, signed and sealed by a qualified professional engineer registered in the State in which the Project is located, verifying ability of each truss design to meet applicable code and design requirements.
      a. Include the following:
         1) Design criteria.
         2) Engineering analysis depicting member stresses and deflections.
         3) Member sizes and gauges.
         4) Details of connections at truss joints.
         5) Truss support reactions.
         6) Bracing requirements.

D. Manufacturer's Installation Instructions: Indicate special procedures, conditions requiring special attention.

E. Fabricator's Qualification Statement.

F. Installer's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Design trusses under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver trusses and other materials in manufacturer's unopened bundles or containers, each marked with manufacturer's name, brand, type, and grade. Exercise care to avoid damage during unloading, storing, and erection.

B. Store trusses on blocking, pallets, platforms, or other supports, off the ground and in an upright position, sufficiently braced to avoid damage from excessive bending. Gently slope stored trusses to avoid accumulation of water on interior of truss chord members.

C. Protect trusses and accessories from contact with earth, corrosion, deformation, mechanical damage, or other deterioration when stored at project site.

PART 2 PRODUCTS

2.01 TRUSS DESIGN REQUIREMENTS

A. Design: Calculate structural characteristics of cold-formed steel truss members according to AISI S100.

B. Structural Performance: Design, engineer, fabricate, and erect trusses to withstand specified design loads for project conditions within required limits.
   1. Design Loads: In accordance with applicable codes and as indicated on drawings
   2. Deflections: Live load deflection meeting the following, unless otherwise indicated:
      a. Roofs: Maximum vertical deflection under live load of 1/240 of span.
   3. Design trusses to accommodate movement attributable to temperature changes within a range of 120 degrees F without damage or overstressing, sheathing failure, undue strain on fasteners and anchors, or other deleterious effects.

2.02 COMPONENTS

A. Trusses: Light gauge steel assemblies providing a complete horizontal framing system for locations indicated, ready for deck installation.
   1. Truss Type, Span, and Height: As indicated on drawings.
   2. Chord and Web Members: Fabricate required shapes from commercial quality galvanized steel sheet complying with ASTM A653/A653M, with minimum yield strength of 40,000 psi; minimum G60/Z180 coating; gauges as required for load conditions; all edges rolled or closed.

B. Fasteners: Self-drilling, self-tapping screw fasteners with corrosion-resistant plated finish, as recommended by steel truss manufacturer and marked for easy identification.
   1. Welding: Comply with applicable provisions of AWS D1.1/D1.1M and AWS D1.3/D1.3M.

C. Bracing, Bridging, and Blocking Members: Fabricate required shapes from commercial quality galvanized steel sheet complying with ASTM A653/A653M, with minimum yield strength of 33,000 psi; minimum G60/Z180 coating; gauges as required for load conditions.

2.03 FABRICATION

A. Factory fabricate cold-formed steel trusses plumb, square, true to line, and with secure connections, complying with manufacturer's recommendations and project requirements.
   1. Fabricate trusses using jig templates.
   2. Cut truss members by sawing, shearing, or plasma cutting.
   3. Fasten members in full compliance with instructions of manufacturer. Wire tying of framing members is not permitted.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine structure, substrates, and installation conditions. Notify Architect of unsatisfactory preparation. Do not begin installation until substrates have been properly prepared and unsatisfactory conditions have been corrected.

B. Proceeding with installation indicates installer's acceptance of substrate conditions.

3.02 INSTALLATION

A. Install cold-formed steel trusses in strict accordance with manufacturer's instructions and approved shop drawings, using approved fastening methods.

B. Install temporary erection bracing and permanent bracing and bridging before application of any loads. Erect trusses with plane of truss webs vertical and parallel to each other, accurately located at spacing indicated. Anchor trusses securely at bearing points.

C. Adequately distribute applied loads to avoid exceeding the carrying capacity of any one joint, truss, or other component.

D. Exercise care to avoid damaging truss members during lifting and erection and to minimize horizontal bending of trusses.

E. Removal, cutting, or alteration of any truss chord, web, or bracing member in the field is prohibited, unless approved in advance by Architect or the engineer of record and the truss manufacturer.

F. Repair or replace damaged members and complete trusses as directed and approved in writing by Architect or the engineer of record and the truss manufacturer.

G. Galvanizing Repair: Touch up bare steel with zinc-rich paint in compliance with ASTM A780/A780M.

H. Roof Trusses:
   1. Comply with recommendations of CFSEI 5000.
   2. Align truss bottom chords with load-bearing studs or continuously reinforce track as required to transfer loads to structure.
   3. Install continuous bridging and permanent truss bracing as indicated.
   4. Install roof cross bracing and diagonal bracing as indicated.

3.03 FIELD QUALITY CONTROL

A. Owner / Library will provide inspection service for inspection of field connections, in accordance with requirements of Section 01 40 00 - Quality Requirements.

3.04 PROTECTION

A. Protect trusses from damage by subsequent construction activities.

B. Repair or replace damaged trusses, truss members, and bracing members; obtain approval in advance by Architect or the engineer of record and the truss manufacturer for all cutting, repairs, and replacements.

END OF SECTION

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SECTION 05 50 00
METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop fabricated steel items.

1.02 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2020.

C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

D. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2018.

E. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2014.

F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.

G. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2018a.

H. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020.

I. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel; 2018.

J. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.

K. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
   1. Design data: Submit drawings and supporting calculations, signed and sealed by a qualified professional structural engineer.
      a. Include the following, as applicable:
         1) Design criteria.
         2) Member sizes and gages.
         3) Details of connections.
         4) Bracing requirements.

C. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.

D. Designer's Qualification Statement.

E. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

1.04 QUALITY ASSURANCE

A. Design elements under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

B. Fabricator Qualifications: A qualified steel fabricator that is accredited by IAS AC172.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.

C. Plates: ASTM A283/A283M.

D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.

E. Slotted Channel Framing: ASTM A653/A653M, Grade 33.

F. Slotted Channel Fittings: ASTM A1011/A1011M.

G. Mechanical Fasteners: Same material as or compatible with materials being fastened; type consistent with design and specified quality level.

H. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

I. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

J. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

D. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 FABRICATED ITEMS

A. Bollards: Steel pipe, concrete filled, crowned cap, as detailed; prime paint finish.

B. Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of masonry; galvanized finish at exterior. Paint at interior.

2.04 FINISHES - STEEL

A. Prime paint steel items.
   1. Exceptions: Galvanize items to be embedded in concrete and items to be embedded in masonry.

B. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

C. Prime Painting: One coat.

D. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

2.05 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Field weld components as indicated on drawings.

D. Perform field welding in accordance with AWS D1.1/D1.1M.

E. Obtain approval prior to site cutting or making adjustments not scheduled.

F. After erection, prime welds, abrasions, and surfaces not shop primed , except surfaces to be in contact with concrete.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

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SECTION 05 51 00
METAL STAIRS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Stairs with concrete treads.

B. Structural steel stair framing and supports.

C. Handrails and guards.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete fill in stair pans; mesh reinforcement for landings.

B. Section 03 30 00 - Cast-in-Place Concrete: Placement of metal anchors in concrete.

C. Section 04 20 00 - Unit Masonry: Placement of metal fabrications in masonry.

D. Section 05 52 13 - Pipe and Tube Railings: Metal handrails and balusters other than specified in this section.

1.03 REFERENCE STANDARDS

A. AISC 201 - AISC Certification Program for Structural Steel Fabricators, Standard for Steel Building Structures; 2006.

B. ASTM A6/A6M - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling; 2019.

C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2020.

E. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

F. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2018.

G. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2021.

H. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2014.

I. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2018.

J. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2018a.

K. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2019, with Editorial Revision (2020).

L. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.

M. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2014 (Amended 2015).

N. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020.

O. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.

P. SSPC-SP 2 - Hand Tool Cleaning; 2024.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
   2. Include the design engineer's seal and signature on each sheet of shop drawings.

C. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

D. Designer's Qualification Statement.

E. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is certified under AISC 201.

1.05 QUALITY ASSURANCE

A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located, or personnel under direct supervision of such an engineer.

B. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and dated no more than 12 months before start of scheduled welding work.

C. Fabricator Qualifications:
   1. A qualified steel fabricator that is certified by the American Institute for Steel Construction (AISC) under AISC 201.

PART 2 PRODUCTS

2.01 METAL STAIRS - GENERAL

A. Metal Stairs: Provide stairs of the design specified, complete with landing platforms, vertical and horizontal supports, railings, and guards, fabricated accurately for anchorage to each other and to building structure.
   1. Regulatory Requirements: Provide stairs and railings that comply with most stringent requirements of local, state, and federal regulations; where requirements of Contract Documents exceed those of regulations, comply with Contract Documents.
   2. Handrails: Comply with applicable accessibility requirements of ADA Standards.
   3. Structural Design: Provide complete stair and railing assemblies that comply with the applicable local code.
      a. Stair Capacity: Uniform live load of 100 lb/sq ft and a concentrated load of 300 lb with deflection of stringer or landing framing not to exceed 1/360 of span.
      b. Railing Assemblies: Comply with applicable local code.
   4. Dimensions: As indicated on drawings.
   5. Shop assemble components; disassemble into largest practical sections suitable for transport and access to site.
   6. No sharp or rough areas on exposed travel surfaces and surfaces accessible to touch.
   7. Separate dissimilar metals using paint or permanent tape.

B. Metal Jointing and Finish Quality Levels:
   1. Architectural: All joints as inconspicuous as possible, whether welded or mechanical.
      a. Welded Joints: Continuously welded and ground smooth and flush.
      b. Mechanical Joints: Butted tight, flush, and hairline; concealed fastenings only.
      c. Exposed Edges and Corners: Eased to small uniform radius.
      d. Metal Surfaces to be Painted: Sanded or ground smooth, suitable for highest quality gloss finish.

C. Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.

D. Anchors and Related Components: Same material and finish as item to be anchored, except where specifically indicated otherwise; provide all anchors and fasteners required.

2.02 METAL STAIRS WITH CONCRETE TREADS

A. Jointing and Finish Quality Level: Architectural, as defined above.

B. Risers: Closed.

C. Treads: Metal pan with field-installed concrete fill.
   1. Concrete Depth: 1-1/2 inches, minimum.
   2. Tread Pan Material: Steel sheet.
   3. Tread Pan Thickness: As required by design; 14 gauge, 0.075 inch minimum.
   4. Pan Anchorage to Stringers: Welded to carrier angles welded to stringers.
   5. Concrete Reinforcement: Welded wire mesh.
   6. Concrete Finish: For carpet and sealed concrete as scheduled.

D. Risers: Same material and thickness as tread pans.
   1. Nosing Depth: Not more than 1-1/2 inch overhang.
   2. Nosing Return: Flush with top of concrete fill, not more than 1/2 inch wide.

E. Stringers: Rolled steel channels.
   1. Stringer Depth: 10 inches.
   2. End Closure: Sheet steel of same thickness as risers welded across ends.

F. Landings: Same construction as treads, supported and reinforced as required to achieve design load capacity.

G. Railings: Steel pipe railings with custom guardrail design, see drawings.

H. Finish: Shop- or factory-prime painted.

I. Under Side of Stair: Exposed to view, to be finished same as specified for other exposed to view surfaces.

2.03 HANDRAILS AND GUARDS

A. Wall-Mounted Rails: See Section 05 52 13.

B. Guards: See Section 05 52 13.

2.04 MATERIALS

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A500/A500M or ASTM A501/A501M structural tubing, round and shapes as indicated.

C. Steel Plates: ASTM A6/A6M or ASTM A283/A283M.

D. Pipe: ASTM A53/A53M Grade B Schedule 40, black finish.

E. Ungalvanized Steel Sheet: Hot- or cold-rolled, except use cold-rolled where finished work will be exposed to view.
   1. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Designation CS (commercial steel).
   2. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Designation CS (commercial steel).

F. Concrete Fill: See Section 03 30 00.

G. Concrete Reinforcement: Mesh type as detailed, galvanized.

2.05 ACCESSORIES

A. Steel Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, and galvanized to ASTM A153/A153M where connecting galvanized components.

B. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

C. Shop and Touch-Up Primer: SSPC-Paint 15, and comply with VOC limitations of authorities having jurisdiction.

2.06 SHOP FINISHING

A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

B. Do not prime surfaces in direct contact with concrete or where field welding is required.

C. Prime Painting: Use specified shop- and touch-up primer.
   1. Preparation of Steel: In accordance with SSPC-SP 2 Hand Tool Cleaning.
   2. Number of Coats: One.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. When field welding is required, clean and strip primed steel items to bare metal.

B. Supply items required to be cast into concrete and embedded in masonry with setting templates.

3.03 INSTALLATION

A. Install components plumb and level, accurately fitted, free from distortion or defects.

B. Provide anchors, plates, angles, hangers, and struts required for connecting stairs to structure.

C. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

D. Provide welded field joints where specifically indicated on drawings. Perform field welding in accordance with AWS D1.1/D1.1M.

E. Other field joints may be either welded or bolted provided the result complies with the limitations specified for jointing quality levels.

F. Obtain approval prior to site cutting or creating adjustments not scheduled.

G. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

END OF SECTION

SECTION 05 51 33
METAL LADDERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop-fabricated metal ladders (Steel).

B. Prefabricated ladders (Aluminum).

1.02 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).

B. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements; 2018.

C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2020.

D. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2018.

E. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2014.

F. ASTM B26/B26M - Standard Specification for Aluminum-Alloy Sand Castings; 2018, with Editorial Revision.

G. ASTM B85/B85M - Standard Specification for Aluminum-Alloy Die Castings; 2018, with Editorial Revision.

H. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

I. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

J. ASTM B210/B210M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes; 2019a.

K. ASTM B211/B211M - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire; 2019.

L. ASTM B85/B85M - Standard Specification for Aluminum-Alloy Die Castings; 2018, with Editorial Revision.

M. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.

N. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2014 (Amended 2015).

O. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020.

P. AWS D1.2/D1.2M - Structural Welding Code - Aluminum; 2014, with Errata.

Q. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel; 2018.

R. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.

S. SSPC-SP 2 - Hand Tool Cleaning; 2024.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's data sheets on each ladder safety system product to be used, including installation instructions.

C. Shop Drawings:
   1. Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

2. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

D. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

E. Designer's Qualification Statement.

F. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

1.04 QUALITY ASSURANCE

A. Design under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

B. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and AWS D1.2/D1.2M and dated no more than 12 months before start of scheduled welding work.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.

C. Plates: ASTM A283/A283M.

D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.

E. Mechanical Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.

F. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

G. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.02 MATERIALS - ALUMINUM

A. Extruded Aluminum: ASTM B211/B211M, 6063 alloy, T6 temper.

B. Sheet Aluminum: ASTM B209 (ASTM B209M), 5052 alloy, H32 or H22 temper.

C. Aluminum-Alloy Drawn Seamless Tubes: ASTM B210/B210M, 6063 alloy, T6 temper.

D. Aluminum-Alloy Bars: ASTM B211/B211M, 6061 alloy, T6 temper.

E. Aluminum-Alloy Sand Castings: ASTM B26/B26M.

F. Aluminum-Alloy Die Castings: ASTM B85/B85M .

G. Bolts, Nuts, and Washers: Stainless steel.

2.03 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

D. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.04 FABRICATED LADDERS (INTERIOR)

A. Ladders: Steel; in compliance with ANSI A14.3; with mounting brackets and attachments; prime paint finish.

2.05 PREFABRICATED LADDERS (EXTERIOR ONLY)

A. Prefabricated Ladder: Welded metal unit complying with ANSI A14.3; factory fabricated to greatest degree practical and in the largest components possible.
   1. Components: Manufacturer's standard rails, rungs, treads, handrails. returns, platforms and safety devices complying with the requirements of the MATERIALS article of this section. Provide walk-through ladder extensions.
   2. Materials: Aluminum; ASTM B211/B211M 6063 alloy, T52 temper.
   3. Finish: Manufacturer's standard clear anodized coating, comply with AAMA 611, Class 1.
   4. Manufacturers:
      a. Industrial Ladder & Scaffolding, Inc.: www.anyladder.com/#sle.
      b. O'Keeffe's Inc: Model 504: www.okeeffes.com/#sle.
      c. Precision Ladders, LLC: www.precisionladders.com/#sle.
      d. Or Approved Equal.

2.06 FINISHES - STEEL

A. Prime paint steel items.
   1. Do not prime surfaces where field welding is required.

B. Prepare surfaces to be primed in accordance with SSPC-SP2.

C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

D. Prime Painting: One coat.

2.07 FINISHES - ALUMINUM

A. Exterior Aluminum Surfaces: Class I natural anodized.

B. Interior Aluminum Surfaces: Galvanized.

C. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

2.08 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Perform field welding in accordance with AWS D1.1/D1.1M.

D. Obtain approval prior to site cutting or making adjustments not scheduled.

E. After erection, prime welds, abrasions, and surfaces not shop primed , except surfaces to be in contact with concrete.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

SECTION 05 52 13
PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall mounted handrails.

B. Stair railings and guardrails.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Placement of anchors in concrete.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. AISC 201 - AISC Certification Program for Structural Steel Fabricators, Standard for Steel Building Structures; 2006.

C. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2021.

D. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings; 2013, with Editorial Revision.

E. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

C. Designer's Qualification Statement.

D. Fabricator's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located, or personnel under direct supervision of such an engineer.

B. Welder Qualifications: Show certification of welders employed on the Work, verifying AWS qualification within the previous 12 months.

C. Fabricator Qualifications:
   1. A qualified steel fabricator that is certified by the American Institute for Steel Construction (AISC) under AISC 201.

PART 2 PRODUCTS

2.01 RAILINGS - GENERAL REQUIREMENTS

A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of applicable local code.

B. Distributed Loads: Design railing assembly, wall rails, and attachments to resist distributed force of 75 pounds per linear foot applied to the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E935

C. Concentrated Loads: Design railing assembly, wall rails, and attachments to resist a concentrated force of 200 pounds applied at any point on the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E935

D. Allow for expansion and contraction of members and building movement without damage to connections or members.

E. Dimensions: See drawings for configurations and heights.

1. Top Rails and Wall Rails: 1-1/2 inches diameter, round.

F. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.

G. Provide welding fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

2.02 STEEL RAILING SYSTEM

A. Steel Tube: ASTM A500/A500M Grade B cold-formed structural tubing.

B. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.

C. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.03 FABRICATION

A. Accurately form components to suit specific project conditions and for proper connection to building structure.

B. Fit and shop assemble components in largest practical sizes for delivery to site.

C. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.

D. Welded Joints:
1. Exterior Components: Continuously seal joined pieces by continuous welds. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
2. Interior Components: Continuously seal joined pieces by continuous welds.
3. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply items required to be cast into concrete or embedded in masonry with setting templates, for installation as work of other sections.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.

C. Install railings in compliance with ADA Standards for accessible design at applicable locations.

D. Anchor railings securely to structure.

E. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per floor level, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

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SECTION 06 10 00
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sheathing.

B. Roof-mounted curbs.

C. Roofing nailers.

D. Preservative treated wood materials.

E. Communications and electrical room mounting boards.

F. Concealed wood blocking, nailers, and supports.

1.02 RELATED REQUIREMENTS

A. Section 07 72 00 - Roof Accessories: Prefabricated roof curbs.

B. Section 09 21 16 - Gypsum Board Assemblies: Gypsum-based sheathing.

1.03 REFERENCE STANDARDS

A. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing; 2003 (Reapproved 2017).

B. ASTM D3498 - Standard Specification for Adhesives for Field-Gluing Wood Structural Panels (Plywood or Oriented Strand Board) to Wood Based Floor System Framing; 2019a.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.

D. PS 1 - Structural Plywood; 2009 (Revised 2019).

E. PS 2 - Performance Standard for Wood Structural Panels; 2018.

F. PS 20 - American Softwood Lumber Standard; 2020.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide technical data on wood preservative materials and application instructions.

1.05 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with DOC PS 20 and requirements of specified grading agencies.
   1. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
   2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Moisture Content: S-dry or MC19.

B. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
   1. Lumber: S4S, No. 2 or Standard Grade.
   2. Boards: Standard or No. 3.

C. Alternative blocking for interior wall supports for items listed in subparagraph 3.03:
   1. ClarkDietrich: Danback Flexible Wood Backing
   2. Or approved equal.

2.03 CONSTRUCTION PANELS

A. Subfloor/Underlayment Combination: Any PS 2 type, rated Single Floor.
   1. Bond Classification: Exterior.
   2. Span Rating: 48.
   3. Performance Category: 19/32 PERF CAT.
   4. Edges: Square.

B. Wall Sheathing: Plywood, DOC PS 1 or DOC PS 2, Grade C-D, Exposure I.
   1. Or Oriented Strand Board: DOC PS 2.

C. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.
   1. Plywood shall be provided by the General Prime Contractor (GPC) by skilled carpenters.
      a. This item shall not be delegated to the EC or LV contractor.
   2. General Provisions:
      a. Provide plywood on all walls wider than 12”.
      b. ¾” x4’x8’, standard plywood sheet size.
      c. Fire retardant treatment with verifying stamps.
      d. Grade A/C with A side mounted out, smooth finish, no splinters, dimples or open knots, no texture.
      e. No internal or external voids.
      f. Flat, not warped.
      g. Placed on 1.5” thick furring strips or 1.5” hat channel if mounted on concrete or CMU (so screws don’t dead-end behind plywood when mounting equipment).
      h. Aligned with studs if studs are present. Each edge of plywood shall be on a stud. Split studs at seams.
      i. Mounted vertically, with 8 ft dimension top to bottom, may start at 2” or 4” above floor to account for baseboard or to assist leveling. Does not need to be tight to floor.
      j. All seams flush with each other on all surfaces, no warps, no uneven surfaces, no uneven edges at top, sides or bottom.
      k. Ceramic coated or stainless steel screws to resist corrosion and chemical interaction with firestop treatment of plywood.
      l. Screws to be minimum #12 size, wood screw threads, minimum 2” long, flat head, heavy-duty, Philips, Torx or square drive.
      m. Even pattern 16” O.C. horizontally and 24” O.C. vertically including all corners. (20) screws minimum every 4x8 sheet. Provide additional screws as required to counteract warping and to assure flush surfaces all around.
      n. All screws to be set flush to plywood surface.
      o. Painted light (white, not gray) color, leave one fire stamp visible on every sheet for verification of fire rating.

D. Other Applications:
   1. Plywood Concealed From View But Located Within Exterior Enclosure: PS 1 or PS 2, C-C Plugged or better, Exterior grade.
   2. Plywood Exposed to View But Not Exposed to Weather: PS 1 or PS 2, A-D, or better.
   3. Other Locations: PS 1 or PS 2, C-D Plugged or better.

2.04 ACCESSORIES

A. Fasteners and Anchors:
   1. Metal and Finish: Stainless steel for high humidity and preservative-treated wood locations, unfinished steel elsewhere.

B. Subfloor Adhesives: Waterproof, air cure type, cartridge dispensed; adhesives designed for subfloor applications and complying with either ASTM C557 or ASTM D3498.

PART 3 EXECUTION

3.01 PREPARATION

A. Coordinate installation of rough carpentry members specified in other sections.

3.02 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

3.03 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.

C. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

D. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

E. Provide the following specific non-structural framing and blocking:
   1. Cabinets and shelf supports.
   2. Wall brackets.
   3. Handrails.
   4. Grab bars.
   5. Towel and bath accessories.
   6. Wall-mounted door stops.
   7. Television mounts.
   8. Wall paneling and trim.
   9. Storefront
   10. Joints of tackable wall coverings that occur between studs.
   11. Plaques.
   12. Picture rails.

3.04 ROOF-RELATED CARPENTRY

A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

B. Provide wood curb at all roof openings except where prefabricated curbs are specified and where specifically indicated otherwise. Form corners by alternating lapping side members.

3.05 INSTALLATION OF CONSTRUCTION PANELS

A. Subflooring/Underlayment Combination: Glue and nail to framing; staples are not permitted.

B. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using nails, screws, or staples.
   1. Place water-resistive barrier horizontally over wall sheathing, weather lapping edges and ends.

C. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.
   1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
   2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
   3. Install adjacent boards without gaps.
   4. Size and Location: As indicated on drawings.

3.06 CLEANING

A. Waste Disposal: Comply with the requirements of Section 01 74 19 - Construction Waste Management and Disposal.
   1. Comply with applicable regulations.
   2. Do not burn scrap on project site.
   3. Do not burn scraps that have been pressure treated.
   4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.

B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

SECTION 06 20 00
FINISH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Finish carpentry items.

B. Wood door frames, glazed frames.

C. Wood casings and moldings.

D. Hardware and attachment accessories.

E. Picture Rail System.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Support framing, grounds, and concealed blocking.

1.03 REFERENCE STANDARDS

A. ANSI A135.4 - Basic Hardboard; 2012 (Reaffirmed 2020).

B. ANSI A208.1 - American National Standard for Particleboard; 2016.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.

D. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014, with Errata (2018).

E. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1; 2017, with Errata (2019).

F. AWPA U1 - Use Category System: User Specification for Treated Wood; 2018.

G. BHMA A156.9 - American National Standard for Cabinet Hardware; 2015.

H. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; 2020.

I. NHLA G-101 - Rules for the Measurement & Inspection of Hardwood & Cypress; 2015.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data:
   1. Provide manufacturer's product data, storage and handling instructions for factory-fabricated units.
   2. Provide data on fire retardant treatment materials and application instructions.

C. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
   1. Provide the information required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).

D. Samples: Submit two samples of wood trim 6 inch long.

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
   1. Single Source Responsibility: Provide and install this work from single fabricator.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store finish carpentry items under cover, elevated above grade, and in a dry, well-ventilated area not exposed to heat or sunlight.

B. Protect from moisture damage.

C. Handle materials and products to prevent damage to edges, ends, or surfaces.

PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Surface Burning Characteristics: Provide materials having fire and smoke properties as required by applicable code. Combustible material in Type II Construction is:
   1. Fire-Retardant-Treated Wood shall be provided at exterior walls, balconies, canopies, and rated interior walls.
   2. Combustible (non-fire-retardant-treated) wood shall be provided at interior wall blocking, interior trim, and millwork such as doors and door frames. Roof blocking and nailers can be combustible.

C. Interior Woodwork Items:
   1. Moldings, Bases, Casings, and Miscellaneous Trim: Natural Birch; stain finish.
   2. Door, Glazed Light Frames: Natural Birch; stain finish.

2.02 LUMBER MATERIALS

A. Hardwood Lumber: Birch species, rotary sawn, respectively, maximum moisture content of 6 percent ; with vertical grain , of quality suitable for transparent finish.
   1. Grading: In accordance with NHLA G-101 Grading Rules; www.nhla.org.

B. Hardwood Lumber: Poplar species, plain sawn, maximum moisture content of 6 percent ; with vertical grain , of quality suitable for **opaque finish**.
   1. Grading: In accordance with NHLA G-101 Grading Rules; www.nhla.org.

2.03 SHEET MATERIALS

A. Hardwood Plywood: Face species as indicated, cut as indicated, book matched, medium density fiberboard core; HPVA HP-1 Front Face Grade AA, Back Face Grade 1, glue type as recommended for application.

B. Particleboard: ANSI A208.1 Composed of wood chips, sawdust, or flakes of medium density, made with waterproof resin binders; of grade to suit application; sanded faces.

C. Hardboard: ANSI A135.4 Pressed wood fiber with resin binder, Class 1 - Tempered, 1/4 inch thick, smooth one side (S1S).

2.04 FASTENINGS

A. Fasteners: Of size and type to suit application; zinc finish in concealed locations and stainless steel finish in exposed locations.

2.05 ACCESSORIES

A. Adhesive: Type recommended by fabricator to suit application.

B. Lumber for Shimming and Blocking: as specified in section 06 10 00 Rough Carpentry.

C. Wood Filler: Solvent base, tinted to match surface finish color.

2.06 HARDWARE

A. Hardware: Comply with BHMA A156.9.

B. Shelf Standards: Oversized Wall Standards style, Electro-Plated Steel finish; 83 Series manufactured by Knape & Vogt.

C. Shelf Brackets: Flanged Bracket System style, Electro-Plated Steel finish; 183 Series manufactured by Knape & Vogt.

D. Specialty Workstation and Countertop Brackets:
   1. Material: Steel.
   2. Finish: Manufacturer's standard, factory-applied powder coat.
   3. Color: Selected by Architect from manufacturer's standard range.

E. Americans with Disabilities Act (ADA)-Compliant Vanity and Countertop Brackets:
   1. Material: Steel.
   2. Finish: Manufacturer's standard, factory-applied primer.
   3. Color: Black.

2.07 PICTURE RAIL SYSTEM

A. Wall-mounted art hanging system, Basis-of-Design from Walker Display.
   1. Locations: As identified on drawings on Women With Words Art Wall.
   2. Contractor to furnish a complete system.
      a. Timeless Modern Molding; SIlver; 72" lengths (cut to wall dimension).
      b. End Caps; Silver at each exposed end of molding.
      c. Lock-on Rod Sleeve; SIlver; 10 per 72" molding.
      d. Stainless Steel Cable; 6' length; 10 cable lengths per 72" molding.
      e. Sing Clip; 20 pack per 72" molding
      f. Cable Hooks; 10 pack per 72" molding.

2.08 WOOD TREATMENT

A. Factory-Treated Lumber: Comply with requirements of AWPA U1 - Use Category System for pressure impregnated wood treatments determined by use categories, expected service conditions, and specific applications.

B. Fire Retardant Treatment (FR-S Type): Chemically treated and pressure impregnated; capable of providing flame spread index of 25, maximum, and smoke developed index of 450, maximum, when tested in accordance with ASTM E84.

C. Wood Preservative by Pressure Treatment (PT Type): Provide AWPA U1 treatment using waterborne preservative with 0.25 percent retainage.

D. Provide identification on fire retardant treated material.

E. Redry wood after pressure treatment to maximum 19 percent moisture content.

2.09 SITE FINISHING MATERIALS

A. Stain, Shellac, Varnish, and Finishing Materials: In compliance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Finishing: Field finished as specified in Section 09 93 00.

2.10 FABRICATION

A. Shop assemble work for delivery to site, permitting passage through building openings.

B. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

2.11 SHOP FINISHING

A. Apply wood filler in exposed nail and screw indentations.

B. On items to receive transparent finishes, use wood filler that matches surrounding surfaces and is of type recommended for the applicable finish.

C. Stain, seal, and varnish exposed to view surfaces. Brush apply only.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

3.02 INSTALLATION

A. Install custom fabrications in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.

B. Set and secure materials and components in place, plumb and level.

C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.

3.03 PREPARATION FOR SITE FINISHING

A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.

3.04 TOLERANCES

A. Maximum Variation from True Position: 1/16 inch.

B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

END OF SECTION

SECTION 06 41 00
ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Specially fabricated cabinet units, laminate and wood.

B. Hardware including cash drawer

1.02 RELATED REQUIREMENTS

A. Section 09 93 00 - Staining and Transparent Finishing: Field finishing of cabinet exterior.

B. Section 12 36 00 - Countertops.

1.03 REFERENCE STANDARDS

A. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1; 2017, with Errata (2019).

B. BHMA A156.9 - American National Standard for Cabinet Hardware; 2015.

C. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; 2020.

D. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.

C. Product Data: Provide data for hardware accessories.

D. Samples: For each exposed product and for each color and texture specified, in manufacturer's or fabricator's standard size.

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
   1. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
   2. Comply with AWI Standards; AWI QPC label not required.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect units from moisture damage.

1.07 FIELD CONDITIONS

A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 PRODUCTS

2.01 CABINETS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Wood Veneer Faced Cabinet - Circulation Desk, Fireplace Shelving:
   1. Exposed Surfaces: HPVA HP-1 Grade A, Birch, rotary cut, book-matched.
   2. Semi-Exposed Surfaces: HPVA HP-1 Grade B, Birch, rotary cut, random-matched.
   3. Concealed Surfaces: Thermoset decorative panels.
   4. Drawer Bottoms: Solid Wood.

C. Wood Veneer Faced Cabinet - Children's and Discover Zone:
   1. Exposed Surfaces: HPVA HP-1 Grade A, White Maple, plain sliced, book-matched.

2. Semi-Exposed Surfaces: HPVA HP-1 Grade B, White Maple, plain sliced, random-matched.
3. Concealed Surfaces: Thermoset decorative panels.
4. Drawer Bottoms: Solid Wood.

D. Plastic Laminate Faced Cabinets: Custom grade.

E. Cabinets:
1. Finish - Exposed Exterior Surfaces: Wood or Laminate, as indicated on drawings.
2. Finish - Exposed Interior Surfaces: Thermoset Decorative laminate.
3. Finish - Semi-Exposed Surfaces: Wood or Laminate, as indicated on drawings.
4. Finish - Concealed Surfaces: Manufacturer's option.
5. Door and Drawer Front Edge Profiles: Square edge with thin applied band.
6. Door and Drawer Front Retention Profiles: Fixed panel.
7. Casework Construction Type: Type A - Frameless.
8. Grained Face Layout for Cabinet and Door Fronts: Flush panel.
   a. Custom Grade: Doors, drawer fronts and false fronts wood grain to run and match vertically within each cabinet unit.
9. Adjustable Shelf Loading: 50 lbs. per sq. ft.
   a. Deflection: L/144.
10. Cabinet Style: Flush overlay.
11. Cabinet Doors and Drawer Fronts: Flush style.
12. Drawer Side Construction: Multiple-dovetailed.
13. Drawer Construction Technique: Dovetail joints.
14. Dust Panels: 1/4-inch plywood or tempered hardboard above compartments and drawers unless located directly under tops.

2.02 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

2.03 LAMINATE MATERIALS

A. Manufacturers:
1. Formica Corporation: www.formica.com/#sle.
2. Pionite
3. Nevamar Company, LLC; Decorative Products Div.
4. Wilsonart LLC; www.wilsonart.com/#sle.

B. Colors: As indicated in Section 09 00 00 "Finishes and Materials Legend".

C. Thermally Fused Laminate (TFL): Melamine resin, NEMA LD 3, Type VGL laminate panels.

D. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.

E. Provide specific types as indicated.
1. Horizontal Surfaces: HGS, 0.048 inch nominal thickness, through color, finish as indicated.
2. Vertical Surfaces: VGS, 0.028 inch nominal thickness, through color, finish as indicated.
3. Post-Formed Horizontal Surfaces: HGP, 0.039 inch nominal thickness, through color, finish as indicated.

2.04 COUNTERTOPS

A. Countertops are specified in Section 12 36 00.

2.05 ACCESSORIES

A. Adhesive: Type recommended by fabricator to suit application.

B. Plastic Edge Banding: Extruded PVC, convex shaped; smooth finish; self locking serrated tongue; of width to match component thickness.
1. Color: As selected by Architect from manufacturer's standard range.

C. Fasteners: Size and type to suit application.

D. Concealed Joint Fasteners: Threaded steel.

E. Grommets: Standard plastic, painted metal, or rubber grommets for cut-outs, in color to match adjacent surface.

F. Safety Glass: ASTM C1048, fully tempered; clear; 1/8 inch thick, minimum.

2.06 HARDWARE

A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.

B. Adjustable Shelf Supports: Standard side-mounted system using multiple holes for pin supports and coordinated self rests, polished chrome or satin chrome finish, for nominal 1 inch spacing adjustments.

C. Drawer and Door Pulls: "U" shaped wire pull, steel with satin finish, 4 inch centers.

D. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with satin finish.

E. Cabinet Catches and Latches:

F. Drawer Slides:
   1. Type: Full extension with overtravel.
   2. Static Load Capacity: Extra Heavy Duty grade.
   3. Mounting: Side mounted.
   4. Stops: Integral type.
   5. Features: Provide self closing/stay closed type.

G. Hinges: European style concealed self-closing type, steel with nickel-plated finish.

H. Soft Close Adapter: Concealed, frame-mounted, screw-adjustable damper; steel with polished finish.

I. Hooks: Surface-mounted; stainless steel, satin finish.

J. Standoffs: Silver, 1” diameter, ½” high base, 1/4” cap height, tamper resistant.

K. Cash Drawer: Countertop-Mounted removable tray cash drawer
   1. Basis-of-Design: Sparco Cash Drawer 15504 Removable 10 Compartment Tray
      a. Dimensions: 17 13/16" Wide by 15-13/16" Deep by 3-14/16" High
      b. Color: Gray

2.07 SITE FINISHING MATERIALS

A. Stain, Shellac, Varnish, and Finishing Materials: In compliance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Finishing: Field finished as specified in Section 09 93 00.

2.08 FABRICATION

A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.

B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.

C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.

D. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.

E. Matching Wood Grain: Comply with requirements of quality standard for specified Grade and as follows:
   1. Provide center matched panels at each elevation.
   2. Provide sequence matching across each elevation.

3. Carry figure of cabinet fronts to toe kicks.

2.09 SHOP FINISHING

A. Sand work smooth and set exposed nails and screws.

B. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify location and sizes of utility rough-in associated with work of this section.

3.02 INSTALLATION

A. Install work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.

B. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.

C. Use fixture attachments in concealed locations for wall mounted components.

D. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.

E. Secure cabinets to floor using appropriate angles and anchorages.

3.03 ADJUSTING

A. Adjust moving or operating parts to function smoothly and correctly.

3.04 CLEANING

A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION

SECTION 06 83 16
FIBERGLASS REINFORCED PANELING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fiberglass reinforced plastic panels.

B. Trim.

1.02 REFERENCE STANDARDS

A. 9 CFR 416.2 - Regulatory Requirements Under the Federal Meat Inspection Act and the Poultry Products Inspection Act, Part 416-Sanitation; current edition.

B. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2010 (Reapproved 2018).

C. ASTM D2583 - Standard Test Method for Indentation Hardness of Rigid Plastics by Means of Barcol Impressor; 2013a.

D. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2016.

E. ASTM D5319 - Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels; 2017.

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.

G. ISO 846 - Plastics - Evaluation of the action of microorganisms; 2019.

H. ISO 2812-1 - Paints and varnishes -- Determination of resistance to liquids -- Part 1: Immersion in liquids other than water; 2017.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

C. Samples: Submit two samples 6 by 6 inch in size illustrating material and surface design of panels.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store panels flat, indoors, on a clean, dry surface. Remove packaging and allow panels to acclimate to room temperature for 48 hours prior to installation.

PART 2 PRODUCTS

2.01 PANEL SYSTEMS

A. Wall Panels:
   1. Panel Size: As required at mop basins.
   2. Panel Thickness: 0.09 inch.
   3. Surface Design: Embossed.
   4. Color: As selected by Architect.
   5. Attachment Method: Adhesive only, with trim and sealant in joints.

2.02 MATERIALS

A. Panels: Fiberglass reinforced plastic (FRP), complying with ASTM D5319.
   1. Surface Burning Characteristics: Maximum flame spread index of 25 and smoke developed index of 450; when system tested in accordance with ASTM E84.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   3. Scratch Resistance: Barcol hardness score greater than 35, when tested in accordance with ASTM D2583.

4. Impact Strength: Greater than 6 ft lb force per inch, when tested in accordance with ASTM D256.
5. Sanitation and Cleanability: Comply with 9 CFR 416.2.
6. Chemical Cleanability: Excellent chemical resistance to common cleaners and detergents when tested in accordance with ISO 2812-1.
7. Biological Resistance: Rating of 0, when tested in accordance with ISO 846.

B. Trim: Vinyl; color coordinating with panel.

C. Adhesive: Type recommended by panel manufacturer.

D. Sealant: Type recommended by panel manufacturer; white.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions and substrate flatness before starting work.

B. Verify that substrate conditions are ready to receive the work of this section.

3.02 INSTALLATION - WALLS

A. Install panels in accordance with manufacturer's instructions.

B. Cut and drill panels with carbide tipped saw blades, drill bits, or snips.

C. Apply adhesive to the back side of the panel using trowel as recommended by adhesive manufacturer.

D. Apply panels to wall with seams plumb and pattern aligned with adjoining panels.

E. Install panels with manufacturer's recommended gap for panel field and corner joints.

F. Place trim on panel before fastening edges, as required.

G. Fill channels in trim with sealant before attaching to panel.

H. Install trim with adhesive and screws or nails, as required.

I. Seal gaps at floor, ceiling, and between panels with applicable sealant to prevent moisture intrusion.

J. Remove excess sealant after paneling is installed and prior to curing.

END OF SECTION

SECTION 07 01 50.19
PREPARATION FOR RE-ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Replacement of existing roofing system in preparation for entire new roofing system.

B. Temporary roofing protection.

1.02 RELATED REQUIREMENTS

A. Section 07 53 00 - Elastomeric Membrane Roofing.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with affected mechanical and electrical work associated with roof penetrations.

B. Preinstallation Meeting: Convene one week before starting work of this section.
   1. Attendees:
      a. Architect.
      b. Contractor.
      c. Owner / Library.

1.04 QUALITY ASSURANCE

A. Materials Removal Company Qualifications: Company specializing in performing work of type specified with at least three years of documented experience.
   1. Comply with removal and disposal regulations of local authorities having jurisdiction (AHJ).

1.05 FIELD CONDITIONS

A. Existing Roofing System: Membrane and Asphalt Shingles roofing.

B. Do not remove existing roofing membrane when weather conditions threaten the integrity of building contents.

PART 2 PRODUCTS

2.01 COMPONENTS

A. Refer to following sections for additional information on components relating to this work:
   1. Replacement and removal of existing roofing system in preparation for entire new roofing system, refer to Sections 07 53 00 and 07 31 13.

2.02 MATERIALS

A. Temporary Roofing Protection Materials:
   1. Contractor's responsibility to select appropriate materials for temporary protection of roofing areas as determined necessary for this work.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing roof surface has been cleared of materials being removed from existing roofing system and ready for next phase of work as required.

3.02 PREPARATION

A. Sweep roof surface clean of loose matter.

B. Remove loose refuse and dispose of properly off-site.

3.03 MATERIAL REMOVAL

A. Repair existing wood deck surface to provide smooth working surface for new roof system.

3.04 INSTALLATION

A. Coordinate scope of this work with requirements for installation of new roofing system, refer to Section 07 51 00 for additional requirements.

3.05 PROTECTION

A. Provide temporary protective sheeting over uncovered deck surfaces.

B. Turn sheeting up and over parapets and curbing. Retain sheeting in position with weights.

C. Provide for surface drainage from sheeting to existing drainage facilities.

END OF SECTION

SECTION 07 19 00
WATER REPELLENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water repellents applied to exterior and interior, masonry, stone, and concrete surfaces.

1.02 REFERENCE STANDARDS

A. ASTM C140/C140M - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units; 2022a.

B. ASTM D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings; 2005 (Reapproved 2018).

C. ASTM D5095 - Standard Test Method for Determination of the Nonvolatile Content in Silanes, Siloxanes, and Silane-Siloxane Blends Used in Masonry Water Repellent Treatments; 1991 (Reapproved 2022).

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide product description, details of tests performed, limitations, and chemical composition.

C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention; cautionary procedures required during application.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Manufacturer's Qualification Statement.

F. Installer's Qualification Statement.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.

B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience

1.05 MOCK-UPS

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Prepare representative surface 36 by 36 inches in size using specified materials and preparation and application methods on surfaces identical to those to be coated; approved mock-up constitutes standard for workmanship.

C. Locate at an inconspicuous location on the historic building.

D. Mock-up may remain as part of work.

1.06 FIELD CONDITIONS

A. Protect liquid materials from freezing.

B. Do not apply water repellent when ambient temperature is lower than 50 degrees F or higher than 100 degrees F.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Silane, Siloxane, Silane-Siloxane Blend, and Siliconate Water Repellents:

1. BASF Construction Chemicals: www.buildingsystems.basf.com/#sle.
2. PROSOCO, Inc: www.prosoco.com/#sle.
3. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
4. Or Approved Equal.

2.02 MATERIALS

A. Water Repellent: Non-glossy, colorless, penetrating, water-vapor-permeable, non-yellowing sealer, that dries invisibly leaving appearance of substrate unchanged.
   1. Applications: Vertical surfaces and non-traffic horizontal surfaces.
   2. Number of Coats: Two.
   3. VOC Content: Less than 600 g/L, when tested in accordance with ASTM D3960 or ASTM D5095.
   4. Moisture Absorption When Applied to Masonry: Five percent, maximum, when tested in accordance with ASTM C140/C140M using masonry sample completely coated with water repellent.
   5. Maintains dry appearance when wetted.
   6. Silane, siloxane, silane-siloxane blend, or siliconate that reacts chemically with concrete and masonry.
      a. Manufacturers:
         1) Basis of Design: Tnemec Inc; Prime-A-Pell Plus 662: www.tnemec.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify joint sealants are installed and cured.

C. Verify surfaces to be coated are dry, clean, and free of efflorescence, oil, or other matter detrimental to application of water repellent.

3.02 PREPARATION

A. Protection of Adjacent Work:
   1. Protect adjacent landscaping, property, and vehicles from drips and overspray.
   2. Protect adjacent surfaces not intended to receive water repellent.

B. Prepare surfaces to be coated as recommended by water repellent manufacturer for best results.

C. Do not start work until masonry mortar substrate is cured a minimum of 60 days.

D. Remove loose particles and foreign matter.

E. Scrub and rinse surfaces with water and let dry.

F. Allow surfaces to dry completely to degree recommended by water repellent manufacturer before starting coating work.

3.03 APPLICATION

A. Apply water repellent in accordance with manufacturer's instructions, using procedures and application methods recommended as producing the best results.

B. Apply two coats, minimum.

C. Remove water repellent from unintended surfaces immediately by a method instructed by water repellent manufacturer.

END OF SECTION

SECTION 07 21 00
THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Board insulation and integral vapor retarder at cavity wall construction, perimeter foundation wall, and underside of floor slabs.

B. Batt insulation and vapor retarder in exterior wall, ceiling, and roof construction.

C. Mineral wool for filling interior wall cavities for acoustics.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Field-applied termiticide for concrete slabs and foundations.

B. Section 05 40 00 - Cold-Formed Metal Framing: Board insulation as wall sheathing.

C. Section 07 21 19 - Foamed-In-Place Insulation: Plastic foam insulation other than boards.

D. Section 07 24 00 - Exterior Insulation and Finish Systems: Board insulation on exterior side of walls, finished with weatherproof coating.

E. Section 07 25 00 - Weather Barriers: Separate air barrier and vapor retarder materials.

F. Section 07 53 00 - Elastomeric Membrane Roofing: Insulation specified as part of roofing system.

1.03 REFERENCE STANDARDS

A. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2019.

B. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2017.

C. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2019.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.

E. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components; 2019.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

C. ABAA Field Quality Control Submittals: Submit third-party reports of testing and inspection required by ABAA QAP.

D. ABAA Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.

E. ABAA Installer Qualification: Submit documentation of current contractor accreditation and current installer certification. Keep copies of contractor accreditation and installer certification on project site during and after installation. Present on-site documentation upon request.

1.05 QUALITY ASSURANCE

A. Air Barrier Association of America (ABAA) Quality Assurance Program (QAP); www.airbarrier.org/#sle:
   1. Installer Qualification: Use accredited contractors, certified installers, evaluated materials.
   2. Manufacturer Qualification: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture. Use secondary materials approved in writing by primary material manufacturer.

1.06 FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. Insulation Under Concrete Slabs: Extruded polystyrene (XPS) board.

B. Insulation at Perimeter of Foundation: Extruded polystyrene (XPS) board.

C. Insulation Inside Masonry Cavity Walls: Polyisocyanurate board.

2.02 FOAM BOARD INSULATION MATERIALS

A. Extruded Polystyrene (XPS) Board Insulation: Complies with ASTM C578 with either natural skin or cut cell surfaces.
   1. Type and Compressive Resistance: Type IV, 25 psi (173 kPa), minimum.
   2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
   3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
   4. Type and Thermal Resistance, R-value: Type IV, 5.0 (0.88) per 1 inch thickness at 75 degrees F mean temperature.
   5. Complies with fire resistance requirements indicated on drawings as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.
   6. Board Edges: Square.
   7. Type and Water Absorption: Type VI, 0.3 percent by volume, maximum, by total immersion.
   8. Location: Below-Grade, Building Perimeter.
   9. Manufacturers:
      a. DiversiFoam Products
      b. Kingspan Insulation LLC; GreenGuard XPS Type IV, 25 psi: www.kingspan.com/#sle.
      c. Owens Corning Corporation; FOAMULAR Extruded Polystyrene (XPS) Insulation: www.ocbuildingspec.com/#sle.
      d. Or Approved Equal.

B. Polyisocyanurate (ISO) Board Insulation with Facers Both Sides: Rigid cellular foam, complying with ASTM C1289.
   1. Classifications:
      a. Type II:
         1) Class 1 - Faced with glass fiber reinforced cellulosic felt facers on both major surfaces of core foam.
         2) Compressive Strength: Classes 1-2-3, Grade 1 - 16 psi (110 kPa), minimum.
         3) Thermal Resistance, R-value: At 1-1/2 inch thick; Class 1, Grades 1-2-3 - 8.4 (1.48) at 75 degrees F.
   2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
   3. Smoke Developed Index (SDI): Class A - 450 or less, when tested in accordance with ASTM E84.
   4. Board Size: 48 inch by 96 inch.
   5. Board Edges: Square.
   6. Location: Building Perimeter Cavity Walls, above grade.
   7. Water Vapor Permeance: 0.05 perm, maximum, at 1 inch thickness, and when tested in accordance with ASTM E96/E96M, desiccant method.
   8. Resistance to Fungal Growth: No growth when tested according to ASTM D5590.
   9. Manufacturers:
      a. Carlisle Coatings & Waterproofing, Inc: www.carlisleccw.com/#sle.
      b. DuPont de Nemours, Inc XARMOR: www.building.dupont.com/#sle.

c. Dow Chemical Company: www.dow.com/sle
d. Johns Manville: www.jm.com/#sle.
e. Or approved equal.

2.03 BATT INSULATION MATERIALS

A. Mineral Fiber Batt Insulation: Flexible or semi-rigid preformed batt or blanket, complying with ASTM C665; friction fit; unfaced flame spread index of 0 (zero) when tested in accordance with ASTM E84.
1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
2. Smoke Developed Index: 0 (zero), when tested in accordance with ASTM E84.
3. Thickness: Fill Interior Wall Cavity, as indicated on drawings.
4. Manufacturers:
a. Johns Manville: www.jm.com/#sle.
b. Knauf Insulation: www.knaufinsulation.com/#sle.
c. ROCKWOOL (ROXUL, Inc): www.rockwool.com/#sle.
d. Thermafiber, Inc: www.thermafiber.com/#sle.
e. Or Equal..

2.04 ACCESSORIES

A. Sheet Vapor Retarder: Black polyethylene film for above grade application, 10 mil, 0.010 inch thick.

B. Tape: Reinforced polyethylene film with acrylic pressure sensitive adhesive.
1. Application: Sealing of interior circular penetrations, such as pipes or cables.
2. Width: As required for application.

C. Flashing Tape: Special reinforced film with high performance adhesive.
1. Application: Window and door opening flashing tape.
2. Width: As required for application.
3. Primer: Tape manufacturer's recommended product.

D. Tape joints of rigid insulation in accordance with roofing and insulation manufacturers' instructions.

E. Insulation Fasteners: Appropriate for purpose intended.
1. Length as required for thickness of insulation material and penetration of deck substrate.

F. Adhesive: Type recommended by insulation manufacturer for application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.

B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 BOARD INSTALLATION AT FOUNDATION PERIMETER

A. Install boards vertically and horizontally on foundation perimeter.
1. Butt edges and ends tightly to adjacent boards and to protrusions.

B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.03 BOARD INSTALLATION AT CAVITY WALLS

A. Install boards to accommodate thermally broken wall ties through insulation.
1. Place membrane surface facing out, and tape seal board joints.

B. Install boards horizontally on walls.
1. Place boards to maximize adhesive contact.
2. Install in running bond pattern.

3. Butt edges and ends tightly to adjacent boards and protrusions.

C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

D. Repair any boards damaged during installation. Patch holes less than 1 inch across with flashing tape. Patch holes greater than 1 inch across with matching board material and then seal with flashing tape.

3.04 BOARD INSTALLATION UNDER CONCRETE SLABS

A. Place insulation under slabs on grade after base for slab has been compacted.

B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

C. Prevent insulation from being displaced or damaged while placing vapor retarder and placing slab.

3.05 BATT INSTALLATION

A. Install insulation and vapor retarder in accordance with manufacturer's instructions.

B. Install in wall spaces without gaps or voids. Do not compress insulation.

C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

E. Tape insulation batts in place.

3.06 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

3.07 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

SECTION 07 21 19
FOAMED-IN-PLACE INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Foamed-in-place insulation.
   1. In exterior framed walls.
   2. In exterior wall crevices.
   3. At junctions of dissimilar wall and roof materials.

B. Protective intumescent coating, as needed.

1.02 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2017.

B. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics; 2019.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.

D. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.

E. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description, insulation properties, overcoat properties, and preparation requirements.

C. Manufacturer's Installation Instructions: Indicate special procedures, and perimeter conditions requiring special attention.

D. Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.

E. Installer Qualification: Submit documentation of current contractor accreditation and current installer certification. Keep copies of all contractor accreditation and installer certification on site during and after installation. Present on-site documentation upon request.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified, with minimum three years documented experience, and approved by manufacturer.

1.05 FIELD CONDITIONS

A. Do not apply foam when temperature is below that specified by the manufacturer for ambient air and substrate.

PART 2 PRODUCTS

2.01 MATERIALS

A. Foamed-In-Place Insulation: Medium-density, rigid, closed cell polyurethane foam; foamed on-site, using blowing agent of water or non-ozone-depleting gas.
   1. Thermal Resistance: R-value of 5.0, minimum, per 1 inch thickness at 75 degrees F mean temperature when tested in accordance with ASTM C518.
   2. Water Vapor Permeance: Vapor retarder; 2 perms, maximum, when tested at intended thickness in accordance with ASTM E96/E96M, desiccant method.

3. Water Absorption: Less than 2 percent by volume, maximum, when tested in accordance with ASTM D2842.
4. Air Permeance: 0.04 cfm per square foot, maximum, when tested at intended thickness in accordance with ASTM E2178 at 1.57 psf.
5. Closed Cell Content: At least 90 percent.
6. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.
7. Manufacturers:
   a. BASF Corporation: www.spf.basf.com/#sle.
   b. Dow Chemical Company (The).
   c. Henry Company: www.henry.com/#sle.
   d. Huntsman Building Solutions; https://huntsmanbuildingsolutions.com/en-US
   e. Icynene-Lapolla: www.icynene.com/#sle.
   f. Johns Manville: www.jm.com/#sle.
   g. Or Approved Equal.
8. Insulation Thickness 1.5" minimum.

2.02 ACCESSORIES

A. Primer: As required by insulation manufacturer.

B. Thermal Barrier Protective Coating: Intumescent coating of type recommended by insulation manufacturer and as required to comply with applicable codes. **Required where foam insulation is not covered by 5/8" gypsum board.**
   1. Product: DC315 manufactured by International Fireproof Technology, Inc..

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify work within construction spaces or crevices is complete prior to insulation application.

B. Verify that surfaces are clean, dry, and free of matter that may inhibit insulation or overcoat adhesion.

3.02 PREPARATION

A. Mask and protect adjacent surfaces from over spray or dusting.

B. Apply primer in accordance with manufacturer's instructions.

3.03 APPLICATION

A. Apply insulation in accordance with manufacturer's instructions.

B. Patch damaged areas.

C. Where applied to voids and gaps assure space for expansion to avoid pressure on adjacent materials that may bind operable parts.

D. Trim excess away for applied trim or remove as required for continuous sealant bead.

3.04 PROTECTION

A. Do not permit subsequent construction work to disturb applied insulation.

END OF SECTION

SECTION 07 25 00
WEATHER BARRIERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water-Resistive Barrier: Under exterior wall cladding, over sheathing or other substrate; not air tight or vapor retardant.

B. Air Barriers: Materials that form a system to stop passage of air through exterior walls, joints between exterior walls and roof, and joints around frames of openings in exterior walls.

1.02 RELATED REQUIREMENTS

A. Section 07 21 00 - Thermal Insulation: Vapor retarder installed in conjunction with batt insulation.

1.03 DEFINITIONS

A. Weather Barrier: Assemblies that form either water-resistive barriers, air barriers, or vapor retarders.

B. Vapor Retarder: Air tight barrier made of material that is relatively water vapor impermeable, to the degree specified, with sealed seams and with sealed joints to adjacent surfaces.
   1. Water Vapor Permeance: For purposes of conversion, 57.2 ng/(Pa s sq m) = 1 perm.

1.04 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

B. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on material characteristics.

C. Shop Drawings: Provide drawings of special joint conditions.

D. Warranty Documentation for Installation of Building Rainscreen Assembly: Submit installer warranty and ensure that forms have been completed in Owner / Library's name and registered with installer.

1.06 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the materials manufacturers before, during and after installation.

1.07 SPECIAL BUILDING ENCLOSURE WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 VAPOR RETARDER MATERIALS (AIR BARRIER AND WATER-RESISTIVE)

A. Vapor Retarder Coating: Liquid applied, resilient, UV-resistant coating and associated joint treatment. **At building envelope.**
   1. Water Vapor Permeance: 0.03 perm, maximum, when tested in accordance with ASTM E96/E96M.
   2. VOC Content: Less than 50 g per L when tested in accordance with 40 CFR 59, Subpart D (EPA Method 24).
   3. Air Permeance (ASTM E2178): Pass
   4. Elongation (ASTM D412): 270%
   5. Tensile Strength (ASTM D412): 100 psi (689 kPa)
   6. Surface Burning Characteristics (ASTM E84):
      a. Flame Spread: Class A

b. Smoke Development: Class A
7. Water Penetration Resistance Around Nails (ASTM D1970 Modified): Pass
8. Resistance to Fungal Growth: No growth when tested according to ASTM D5590.
9. Code Acceptance: Comply with applicable requirements of ICC-ES AC212.
10. Suitable for use on concrete, masonry, plywood and gypsum sheathing.
11. Joint Preparation Treatment: Coating manufacturer's recommended method, either tape or reinforcing mesh saturated with coating material.
12. Manufacturers:
    a. Henry Company; Air-Bloc 16MR: www.henry.com/#sle.
    b. Polyguard Products; Polyguard Airlok Flex NP-40.
    c. Tremco; ExoAir 120.
    d. W.R. Meadows, Inc; Air-Shield LSR: www.wrmeadows.com/#sle.
13. Joint Filler: As recommended by coating manufacturer and suitable to the substrate.

2.02 ACCESSORIES

A. Sealants, Tapes, and Accessories for Sealing Weather Barrier and Sealing Weather Barrier to Adjacent Substrates: As specified or as recommended by weather barrier manufacturer.

B. Flexible Flashing: Self-adhesive sheet flashing complying with ASTM D1970/D1970M, except slip resistance requirement is waived if not installed on a roof.
   1. Composition: Butyl rubber sheet laminated to elasticized polyethylene sheet.

C. Liquid Flashing: One part, fast curing, non-sag, elastomeric, gun grade, trowelable liquid flashing.

D. Thinners and Cleaners: As recommended by material manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and conditions are ready to accept the work of this section.

3.02 PREPARATION

A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

B. Clean and prime substrate surfaces to receive adhesives in accordance with manufacturer's instructions.

3.03 INSTALLATION

A. Install materials in accordance with manufacturer's instructions.

B. Vapor Retarders: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.

C. Apply sealants and adhesives within recommended application temperature ranges. Consult manufacturer if temperature is out of this range.

D. Coatings:
   1. Prepare substrate in manner recommended by coating manufacturer; treat joints in substrate and between dissimilar materials as recommended by manufacturer.
   2. Where exterior masonry veneer is to be installed, install masonry anchors before installing weather barrier over masonry; seal around anchors air tight.
   3. Use flashing to seal to adjacent construction and to bridge joints.

E. Openings and Penetrations in Exterior Weather Barriers:
   1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches onto weather barrier and at least 6 inches up jambs; mechanically fasten stretched edges.
   2. At openings to be filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 4 inches wide; do not seal sill flange.

3. At openings to be filled with non-flanged frames, seal weather barrier to each side of opening framing, using flashing at least 9 inches wide, covering entire depth of framing.
4. At head of openings, install flashing under weather barrier extending at least 2 inches beyond face of jambs; seal weather barrier to flashing.
5. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
6. Service and Other Penetrations: Form flashing around penetrating item and seal to weather barrier surface.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Do not cover installed weather barriers until required inspections have been completed.

C. Obtain approval of installation procedures by the weather barrier manufacturer based on a mock-up installed in place, prior to proceeding with remainder of installation.

3.05 PROTECTION

A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION

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SECTION 07 31 13
ASPHALT SHINGLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Asphalt shingle roofing.

B. Flexible sheet membranes for eave protection, underlayment, and valley protection.

C. Associated metal flashings and accessories.

1.02 REFERENCE STANDARDS

A. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2020.

B. ASTM D3161/D3161M - Standard Test Method for Wind-Resistance of Steep Slope Roofing Products (Fan-Induced Method); 2020.

C. ASTM D3462/D3462M - Standard Specification for Asphalt Shingles Made from Glass Felt and Surfaced with Mineral Granules; 2023.

D. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings; 2020a.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating material characteristics.

C. Shop Drawings: For metal flashings, indicate specially configured metal flashings.

D. Samples: Submit two samples of each shingle color indicating color range and finish texture/pattern ; for color selection.

E. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner / Library's name and registered with manufacturer.

F. Maintenance Materials: Furnish the following for Owner / Library's use in maintenance of project.
   1. Extra Shingles: 25 sq ft of each type and color.

1.04 QUALITY ASSURANCE

A. Products are Required to Comply with Fire Resistance Criteria: UL (DIR) listed and labeled.

1.05 FIELD CONDITIONS

A. Do not install shingles or eave protection membrane when surface temperatures are below 45 degrees F.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide lifetime manufacturer's warranty for coverage against black streaks caused by algae.

D. Provide five year manufacturer's warranty for wind damage.

PART 2 PRODUCTS

2.01 ASPHALT SHINGLES

A. Asphalt Shingles: Asphalt-coated glass felt, mineral granule surfaced, complying with ASTM D3462/D3462M.
   1. Fire Resistance: Class A, complying with ASTM E108.
   2. Wind Resistance: Class A, when tested in accordance with ASTM D3161/D3161M.
   3. Algae Resistant.
   4. Self-sealing type.

5. Style: Square.
6. Color: As selected by Architect.

2.02 SHEET MATERIALS

A. Eave Protection Membrane:
   1. Eave Protection Membrane: Self-adhering polymer-modified asphalt sheet complying with ASTM D1970/D1970M; 40 mil total thickness; with strippable treated release paper and polyethylene sheet top surface.
   2. See bid documents for additional locations of self-adhering membrane.

B. Underlayment: Synthetic non-asphaltic sheet, intended by manufacturer for mechanically fastened roofing underlayment without sealed seams.
   1. Self Sealability: Passing nail sealability test specified in ASTM D1970/D1970M.
   2. Low Temperature Flexibility: Passing test specified in ASTM D1970/D1970M.
   3. Water Vapor Permeance: Vapor retarder; maximum of 0.1 perm, when tested in accordance with ASTM E96/E96M Procedure A (desiccant method).
   4. Fasteners: As recommended by manufacturer or building code qualification report or approval.

2.03 ACCESSORIES

A. Roofing Nails: Standard round wire shingle type, galvanized steel, stainless steel, aluminum roofing nails, or copper roofing nails, minimum 3/8 inch head diameter, 12 gage, 0.109 inch nail shank diameter, 1-1/2 inch long and complying with ASTM F1667.

B. Lap Cement: Fibrated cutback asphalt type, recommended for use in application of underlayment, free of toxic solvents.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions prior to beginning work.

B. Verify that roof deck is of sufficient thickness to accept fasteners.

C. Verify that roof penetrations and plumbing stacks are in place and flashed to deck surface.

D. Verify roof openings are correctly framed.

E. Verify deck surfaces are dry, free of ridges, warps, or voids.

3.02 PREPARATION

A. Seal roof deck joints wider than 1/16 inch as recommended by shingle manufacturer.

B. At areas where eave protection membrane is to be adhered to substrate, fill knot holes and surface cracks with latex filler.

C. Broom clean deck surfaces before installing underlayment or eave protection.

3.03 INSTALLATION - EAVE PROTECTION MEMBRANE

A. Install eave protection membrane from eave edge to minimum 4 ft up-slope beyond interior face of exterior wall.

B. Install eave protection membrane in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.

C. Apply 4 inch wide band of plastic cement over deck flange of eave edge flashings, and embed an 18 inch wide strip of eave protection membrane, place starter strip with eave edge flush with face of flashings, secure in place, and lap ends minimum 6 inches.

D. Starting from lower edge of starter strip, lay additional 36 inch wide strips in lap cement, to produce a two ply membrane, weather lap plies minimum 19 inches and nail in place, lap ends minimum 6 inches, and stagger end joints of each consecutive ply.

3.04 INSTALLATION - UNDERLAYMENT

A. Underlayment At Roof Slopes Greater Than 4:12: Install underlayment perpendicular to slope of roof, with ends and edges weather lapped minimum 4 inches, stagger end laps of each consecutive layer, nail in place, and weather lap minimum 4 inches over eave protection.

B. Weather lap and seal watertight with plastic cement any items projecting through or mounted on roof.

3.05 INSTALLATION - VALLEY PROTECTION

A. Install valley protection in accordance with SMACNA (ASMM), Detail ____.

B. Install flexible flashing in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.

3.06 INSTALLATION - SHINGLES

A. Install shingles in accordance with manufacturer's instructions manufacturer's instructions and NRCA (RM) applicable requirements.
   1. Fasten strip shingles using four nails per strip, or as required by manufacturer and local building code, whichever is greater.

B. Place shingles in straight coursing pattern with 5 inch weather exposure to produce double thickness over full roof area, and provide double course of shingles at eaves.

C. Project first course of shingles 3/4 inch beyond fascia boards.

D. Cap hips with individual shingles, maintaining 5 inch weather exposure, and place to avoid exposed nails.

E. Coordinate installation of roof mounted components or work projecting through roof with weather tight placement of counterflashings.

F. Complete installation to provide weather tight service.

3.07 PROTECTION

A. Do not permit traffic over finished roof surface.

END OF SECTION

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SECTION 07 41 13
METAL ROOF PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Architectural roofing system of preformed aluminum panels.

B. Architectural preformed aluminum panels applied on vertical surface, as indicated on exterior elevations.

1.02 RELATED REQUIREMENTS

A. Section 05 12 00 - Structural Steel Framing: Roof framing and purlins.

B. Section 07 42 13 - Metal Wall Panels: Preformed wall panels.

C. Section 07 92 00 - Joint Sealants: Sealing joints between metal roof panel system and adjacent construction.

1.03 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2017a.

B. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

C. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

D. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

E. ASTM E1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference; 2005 (Reapproved 2017).

F. ASTM E1646 - Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference; 2011 (Reapproved 2018).

G. ASTM E1680 - Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems; 2016.

H. UL 580 - Standard for Tests for Uplift Resistance of Roof Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Storage and handling requirements and recommendations.
   2. Installation methods.
   3. Specimen warranty.

C. Shop Drawings: Include layouts of roof panels, details of edge and penetration conditions, spacing and type of connections, flashings, underlayments, and special conditions.
   1. Show work to be field-fabricated or field-assembled.

D. Selection Samples: For each roofing system specified, submit color chips representing manufacturer's full range of available colors and patterns.

E. Manufacturer's qualification statement.

F. Installer's qualification statement.

G. Test Reports: Indicate compliance of metal roofing system to specified requirements.

H. Warranty: Submit specified manufacturer's warranty and ensure that forms have been completed in Owner / Library's name and are registered with manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Provide strippable plastic protection on prefinished roofing panels for removal after installation.

B. Store roofing panels on project site as recommended by manufacturer to minimize damage to panels prior to installation.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Finish Warranty: Provide manufacturer's special warranty covering failure of factory-applied exterior finish on metal roof panels and agreeing to repair or replace panels that show evidence of finish degradation, including significant fading, chalking, cracking, or peeling within specified warranty period of five years from Date of Substantial Completion.

C. Waterproofing Warranty: Provide manufacturer's warranty for weathertightness of roofing system, including agreement to repair or replace roofing that fails to keep out water within specified warranty period of five years from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

2.02 PERFORMANCE REQUIREMENTS

A. Metal Roof Panels: Provide complete roofing assemblies, including roof panels, clips, fasteners, connectors, and miscellaneous accessories, tested for compliance with the following minimum standards:
   1. Structural Design Criteria: Provide panel assemblies designed to safely support design loads at support spacing indicated, with deflection not to exceed L/180 of span length(L) when tested in accordance with ASTM E1592.
      a. Dead Loads: Weight of roofing system.
      b. Live Loads: As required by ASCE 7.
   2. Overall: Complete weathertight system tested and approved in accordance with ASTM E1592.
   3. Wind Uplift: Class 90 wind uplift resistance of UL 580.
   4. Air Infiltration: Maximum 0.06 cfm/sq ft at air pressure differential of 6.24 lbf/sq ft, when tested according to ASTM E1680.
   5. Water Penetration: No water penetration when tested according to procedures and recommended test pressures of ASTM E1646. Perform test immediately following air infiltration test.
   6. Thermal Movement: Design system to accommodate without deformation anticipated thermal movement over ambient temperature range of 100 degrees F.

2.03 ARCHITECTURAL METAL ROOF PANELS

A. Architectural Metal Roof Panels: Provide complete engineered system complying with specified requirements and capable of remaining weathertight while withstanding anticipated movement of substrate and thermally induced movement of roofing system.

B. Architectural Metal Panels: Factory-formed panels with factory-applied finish.
   1. Aluminum Panels:
      a. Alloy and Temper: Aluminum complying with ASTM B209 (ASTM B209M); temper as required for forming.
      b. Thickness: Minimum 20 gauge, 0.032 inch.
   2. Profile: Standing seam, with minimum 1.0 inch seam height; concealed fastener system for field seaming with special tool.
   3. Texture: Smooth.
   4. Length: Full length of roof slope, without lapped horizontal joints.
   5. Width: Maximum panel coverage of 24 inches.

2.04 ATTACHMENT SYSTEM

A. Concealed System: Provide manufacturer's standard stainless steel or nylon-coated aluminum concealed anchor clips designed for specific roofing system and engineered to meet performance requirements, including anticipated thermal movement.

2.05 FABRICATION

A. Panels: Provide factory or field fabricated panels with applied finish and accessory items, using manufacturer's standard processes as required to achieve specified appearance and performance requirements.

B. Joints: Provide captive gaskets, sealants, or separator strips at panel joints to ensure weathertight seals, eliminate metal-to-metal contact, and minimize noise from panel movements.

2.06 FINISHES

A. Fluoropolymer Coil Coating System: Manufacturer's standard multi-coat aluminum coil coating system complying with AAMA 2605, including at least 70 percent polyvinylidene fluoride (PVDF) resin, and at least 80 percent of coil coated aluminum surfaces having minimum total dry film thickness (DFT) of 0.9 mil, 0.0009 inch; color and gloss as selected from manufacturer’s standards.

2.07 ACCESSORIES

A. Miscellaneous Sheet Metal Items: Provide flashings, gutters, downspouts, trim, moldings, closure strips, preformed crickets, caps, and equipment curbs of the same material, thickness, and finish as used for the roofing panels. Items completely concealed after installation may optionally be made of stainless steel.

B. Rib and Ridge Closures: Provide prefabricated, close-fitting components of steel with corrosion resistant finish or combination steel and closed-cell foam.

C. Sealants:
   1. Exposed Sealant: Elastomeric; silicone, polyurethane, or silyl-terminated polyether/polyurethane.
   2. Concealed Sealant: Non-curing butyl sealant or tape sealant.
   3. Seam Sealant: Factory-applied, non-skinning, non-drying type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation of preformed metal roof panels until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Coordinate roofing work with provisions for roof drainage, flashing, trim, penetrations, and other adjoining work to assure that the completed roof will be free of leaks.

B. Remove protective film from surface of roof panels immediately prior to installation. Strip film carefully, to avoid damage to prefinished surfaces.

C. Separate dissimilar metals by applying a bituminous coating, self-adhering rubberized asphalt sheet, or other permanent method approved by roof panel manufacturer.

D. Where metal will be in contact with wood or other absorbent material subject to wetting, seal joints with sealing compound and apply one coat of heavy-bodied bituminous paint.

3.03 INSTALLATION

A. Overall: Install roofing system in accordance with approved shop drawings and panel manufacturer's instructions and recommendations, as applicable to specific project conditions.

Anchor all components of roofing system securely in place while allowing for thermal and structural movement.

1. Install roofing system with concealed clips and fasteners, except as otherwise recommended by manufacturer for specific circumstances.
2. Minimize field cutting of panels. Where field cutting is absolutely required, use methods that will not distort panel profiles. Use of torches for field cutting is absolutely prohibited.

B. Accessories: Install all components required for a complete roofing assembly, including flashings, gutters, downspouts, trim, moldings, closure strips, preformed crickets, caps, equipment curbs, rib closures, ridge closures, and similar roof accessory items.

C. Roof Panels: Install panels in strict accordance with manufacturer's instructions, minimizing transverse joints except at junction with penetrations.

3.04 CLEANING

A. Clean exposed sheet metal work at completion of installation. Remove grease and oil films, excess joint sealer, handling marks, and debris from installation, leaving the work clean and unmarked, free from dents, creases, waves, scratch marks, or other damage to the finish.

3.05 PROTECTION

A. Do not permit storage of materials or roof traffic on installed roof panels. Provide temporary walkways or planks as necessary to avoid damage to completed work. Protect roofing until completion of project.

B. Touch-up, repair, or replace damaged roof panels or accessories before Date of Substantial Completion.

END OF SECTION

SECTION 07 42 13.23
METAL COMPOSITE MATERIAL WALL PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Exterior cladding consisting of formed metal composite material (MCM) sheet, secondary supports, and anchors to structure, attached to solid backup.

B. Matching flashing and trim.

1.02 RELATED REQUIREMENTS

A. Section 05 40 00 - Cold-Formed Metal Framing: Panel support framing.

B. Section 07 25 00 - Weather Barriers: Weather barrier behind wall panel system.

C. Section 07 62 00 - Sheet Metal Flashing and Trim: Metal flashing components integrated with this wall system.

D. Section 07 92 00 - Joint Sealants: Sealing joints between siding and adjacent construction and fixtures.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

D. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2017.

E. ASTM A480/A480M - Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip; 2020.

F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.

G. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

H. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2021.

I. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

J. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

K. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2020.

L. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.

M. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

N. ASTM D1781 - Standard Test Method for Climbing Drum Peel for Adhesives; 1998 (Reapproved 2012).

O. ASTM D1929 - Standard Test Method for Determining Ignition Temperature of Plastics; 2020.

P. ASTM D4145 - Standard Test Method for Coating Flexibility of Prepainted Sheet; 2010 (Reapproved 2018).

Q. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.

R. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.

S. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2016).

T. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components; 2019.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Meeting: Convene one week before starting work of this section to verify project requirements, coordinate with installers of other work, establish condition and completeness of building substrate, and review manufacturers' installation instructions and warranty requirements.
   1. Require attendance by the installer and relevant sub-contractors.
   2. Include MCM sheet manufacturer’s representative and wall system manufacturer’s representative to review storage and handling procedures.
   3. Review in detail truck transportation, parking, vertical transportation, schedule, personnel, installation of adjacent materials and substrate.
   4. Review procedures for protection of work and other construction.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data - MCM Sheets: Manufacturer's data sheets on each product to be used, including thickness, physical characteristics, and finish, and:
   1. Finish manufacturer's data sheet showing physical and performance characteristics.
   2. Storage and handling requirements and recommendations.
   3. Fabrication instructions and recommendations.
   4. Specimen warranty for finish, as specified herein.

C. Product Data - Wall System: Manufacturer's data sheets on each product to be used, including:
   1. Physical characteristics of components shown on shop drawings.
   2. Storage and handling requirements and recommendations.
   3. Installation instructions and recommendations.
   4. Specimen warranty for wall system, as specified herein.

D. Shop Drawings: Show layout and elevations, dimensions and thickness of panels, connections, details and location of joints, sealants and gaskets, method of anchorage, support clips, exposed fasteners, number of anchors, supports, reinforcement, trim, flashings, and accessories.
   1. Indicate panel numbering system.
   2. Differentiate between shop and field fabrication.
   3. Indicate substrates and adjacent work with which the wall system must be coordinated.
   4. Include large-scale details of anchorages and connecting elements.
   5. Include large-scale details or schematic, exploded or isometric diagrams to fully explain flashing at a scale of not less than 1-1/2 inches per 12 inches.
   6. Include design engineer's stamp or seal on shop drawings for attachments and anchors.

E. Selection Samples: For each finish product specified, submit at least three sample color chips representing manufacturer's standard range of available colors and patterns.
   1. Sealant Color: Color to match wall panels.

F. Verification Samples: For each finish product specified, submit at least three samples, minimum size 12 inch square, and representing actual product in color and texture.

G. Design Data: Submit structural calculations stamped by design engineer, for Architect's information and project record.

H. Test Report: Submit report of full-size mock-up tests for air infiltration, water penetration, and wind performance.

I. Test Report: Submit test report verifying compliance with NFPA 285 for previously-tested exterior wall assembly.

J. Designer's Qualification Statement.

K. Manufacturer's Qualification Statement.

L. Installer's Qualification Statement.

M. Testing Agency's Qualification Statement.

N. Maintenance Data: Care of finishes and warranty requirements.

O. Executed Warranty: Submit warranty and ensure that forms have been completed in Owner / Library's name and registered with manufacturer.

P. Warranty Documentation for Installation of Building Rainscreen Assembly: Submit installer warranty and ensure that forms have been completed in Owner / Library's name and registered with installer.

1.06 QUALITY ASSURANCE

A. Field Measurements: Verify actual dimensions by field measurement before fabrication; show recorded measurements on shop drawings.

B. Design Engineer's Qualifications: Design structural supports and anchorages under direct supervision of a Structural Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

C. Manufacturer Qualifications: Company specializing in manufacturing wall panel systems specified in this section.
   1. Approved by MCM sheet manufacturer.

D. Installer Qualifications: Company specializing in performing work of the type specified in this section.
   1. Approved by wall panel system manufacturer.

E. Testing Agency Qualifications: Independent agency experienced in testing assemblies of the type required for this project and having the necessary facilities for full-size mock-up testing of the type specified.

F. Mock-Up: Provide a mock-up for evaluation of fabrication workmanship.
   1. Locate where directed.
   2. Provide panels finished as specified.
   3. Mock-up may remain as part of the work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer's original, unopened, undamaged containers with identification labels intact.
   1. Protect finishes by applying heavy-duty removable plastic film during production.
   2. Package for protection against transportation damage.
   3. Provide markings to identify components consistently with drawings.
   4. Exercise care in unloading, storing, and installing panels to prevent bending, warping, twisting, and surface damage.

B. Store products protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
   1. Store in well-ventilated space out of direct sunlight.
   2. Protect from moisture and condensation with tarpaulins or other suitable weathertight covering installed to provide ventilation.
   3. Store at a slope to ensure positive drainage of accumulated water.
   4. Do not store in enclosed space where ambient temperature can exceed 120 degrees F.

5. Avoid contact with other materials that might cause staining, denting, or other surface damage.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Correct defective work within a five year period after Date of Substantial Completion, including defects in water tightness and integrity of seals for insulated metal wall panel systems.

C. Correct defective work within a ten year period after Date of Substantial Completion for degradation of panel finish, including color fading caused by exposure to weather.

D. Installation Warranty for Building Rainscreen Assembly: Installer of exterior rainscreen assembly (including air/vapor barrier and attachments, framing, and exterior panels) to provide 10-year warranty that includes coverage for defective materials and/or workmanship. This warranty will also clearly include materials, labor, necessary activity to access these areas, and removal of any materials to effect repairs and restore to watertight conditions. www.edacontractors.com/#sle

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Composite Material (MCM) Sheet Manufacturers:
   1. 3A Composites USA; Alucobond Plus (Fire Retardant Core): www.3Acompositesusa.com/#sle.
   2. ALPOLIC Materials; ALPOLIC/fr (Fire Retardant core): www.alpolic-americas.com/#sle.
   3. Alucoil North America LLC; larson by Alucoil, FR Core (fire resistant): www.alucoilnorthamerica.com/#sle.
   4. Alfrex; Alfrex FR MCM
   5. Fairview Architectural LLC; VitraBond (Fire Rated): www.fairview-na.com/#sle.
   6. Or Approved Equal.

2.02 WALL PANEL SYSTEM

A. Wall Panel System: Metal panels, fasteners, and anchors designed to be supported by framing or other substrate provided by others; provide installed panel system capable of maintaining specified performance without defects, damage, or failure.
   1. Provide structural design by or under direct supervision of a Structural Engineer licensed in the State in which the Project is located.
   2. Provide panel jointing and weatherseal using reveal joints and gaskets but no sealant.
   3. Anchor panels to supporting framing without exposed fasteners.

2.03 PERFORMANCE REQUIREMENTS

A. Thermal Movement: Provide for free and noiseless vertical and horizontal thermal movement due to expansion and contraction under material temperature range of minus 20 degrees F to 180 degrees F without buckling, opening of joints, undue stress on fasteners, or other detrimental effects; allow for ambient temperature at time of fabrication, assembly, and erection procedures.
   1. Wind Performance: Provide system tested in accordance with ASTM E330/E330M without permanent deformation or failures of structural members under the conditions identified on the structural drawings.
   2. Maximum deflection of perimeter framing member of L/175 normal to plane of the wall; maximum deflection of individual panels of L/60.
   3. Maximum anchor deflection in any direction of 1/16 inch at connection points of framing members to anchors.

B. Water Penetration: No water penetration under static pressure when tested in accordance with ASTM E331 at a differential of 10 percent of inward acting design load, 6.27 psf minimum, after 15 minutes.

1. Water penetration is defined as the appearance of uncontrolled water on the interior face of the wall.
2. Design to drain leakage and condensation to the exterior face of the wall.

C. Fire Performance: Tested in accordance with, and complying with acceptance criteria of NFPA 285.

2.04 PANELS

A. Panels: 1 inch deep pans formed of metal composite material sheet by routing back edges of sheet, removing corners, and folding edges.
   1. Reinforce corners with riveted aluminum angles.
   2. Provide concealed attachment to supporting structure by adhering attachment members to back of panel; attachment members may also function as stiffeners.
   3. Maintain maximum panel bow of 0.8 percent of panel dimension in width and length; provide stiffeners of sufficient size and strength to maintain panel flatness without showing local stresses or read-through on panel face.
   4. Secure members to back face of panels using structural silicone sealant approved by MCM sheet manufacturer.
   5. Fabricate panels under controlled shop conditions.
   6. Where final dimensions cannot be established by field measurement before commencement of manufacturing, make allowance for field adjustments without requiring field fabrication of panels.
   7. Fabricate as indicated on drawings and as recommended by MCM sheet manufacturer.
      a. Make panel lines, breaks, curves, and angles sharp and true.
      b. Keep plane surfaces free from warp or buckle.
      c. Keep panel surfaces free of scratches or marks caused during fabrication.
   8. Provide joint details providing a watertight and structurally sound wall panel system that allows no uncontrolled water penetration on inside face of panel system.
   9. For "dry" jointing, secure extrusions to returned pan edges with stainless steel rivets; provide means of concealed drainage with baffles and weeps for water that might accumulate in members of system.

2.05 MATERIALS

A. Metal Composite Material (MCM) Sheet: Two sheets of aluminum sandwiching a core of extruded thermoplastic material; no foamed insulation material content.
   1. Overall Sheet Thickness: 0.157 inch, minimum.
   2. Face Sheet Thickness: 0.019 inches, minimum.
   3. Alloy: Manufacturer's standard, selected for best appearance and finish durability.
   4. Bond and Peel Strength: No adhesive failure of the bond between the core and the skin nor cohesive failure of the core itself below 22.4 inch-pound/inch with no degradation in bond performance, when tested in accordance with ASTM D1781, simulating resistance to panel delamination, after 8 hours of submersion in boiling water and after 21 days of immersion in water at 70 degrees F.
   5. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
   6. Flammability: Self-ignition temperature of 650 degrees F or greater when tested in accordance with ASTM D1929.

B. Metal Framing Members: Include sub-girts, zee-clips, base and sill angles and channels, hat-shaped and rigid channels, and furring channels required for complete installation.
   1. Provide material strength, dimensions, configuration as required to meet the applied loads applied and in compliance with applicable building code.
   2. Sheet Steel Components: ASTM A653/A653M galvanized to G90/Z275 or zinc-iron alloy-coated to A60/ZF180; or ASTM A792/A792M aluminum-zinc coated to AZ60/AZM180.
   3. Stainless Steel Sheet Components: ASTM A480/A480M.
   4. Aluminum Components: ASTM B209 (ASTM B209M); or ASTM B221 (ASTM B221M).

2.06 FINISHES

A. Factory Finish: Two coat fluoropolymer resin coating, approved by coating manufacturer for length of warranty specified for project, and applied by coil manufacturing facility that specializes in coil applied finishes.
   1. Coating Flexibility: Pass ASTM D4145 minimum 1T Bend at time of manufacturing.
   2. Long-Term Performance: Not less than that specified under WARRANTY in PART 1.

B. Color/Texture: As selected by Architect from manufacturer's full range.
   1. **Canopy (3) Colors, Balcony (1) colors, may vary.**

2.07 ACCESSORIES

A. Flashing: Sheet aluminum; 0.040 inch thick, minimum; finish and color to match MCM sheet; see Section 07 62 00 for additional requirements.

B. Cladding Support Clips: Thermally-broken, galvanized steel clips for support of cladding z-girts, angles, channels and other framing.
   1. Galvanized Steel Sheet: ASTM A653/A653M, with G90/Z275 galvanized coating.

C. Anchors, Clips, and Accessories: Use one of the following:
   1. Stainless steel complying with ASTM A276/A276M, ASTM A480/A480M, or ASTM A666.
   2. Steel complying with ASTM A36/A36M and hot-dipped galvanized to ASTM A153/A153M.
   3. Steel complying with ASTM A36/A36M and hot-dipped galvanized to ASTM A123/A123M Coating Grade 10.

D. Fasteners:
   1. Exposed Fasteners: Stainless steel; permitted only where absolutely unavoidable and subject to prior approval of the Architect.
   2. Screws: Self-drilling or self-tapping Type 410 stainless steel or zinc-alloy steel hex washer head, with EPDM or PVC washer under heads of fasteners bearing on weather side of metal wall panels.
   3. Bolts: Stainless steel.
   4. Fasteners for Flashing and Trim: Blind fasteners of high-strength aluminum or stainless steel.

E. Joint Sealer: Provide color to match wall panels silicone sealant of type approved by MCM sheet manufacturer, and in compliance with ASTM C920.

F. Provide panel system manufacturer's and installer’s standard corrosion resistant accessories, including fasteners, clips, anchorage devices, and attachments.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine dimensions, tolerances, and interfaces with other work.
   1. Verify that weather barrier system is properly installed; see Section 07 25 00 for requirements.

B. Examine substrate on-site to determine that conditions are acceptable for product installation in accordance with manufacturer's written instructions.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

D. Notify Architect in writing of conditions detrimental to proper and timely completion of work, and do not proceed with erection until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Protect adjacent work areas and finish surfaces from damage during installation.

3.03 INSTALLATION

A. Do not install products that are defective, including warped, bowed, dented, and broken members, and members with damaged finishes.

B. Comply with instructions and recommendations of MCM sheet manufacturer and wall system manufacturer, as well as with approved shop drawings.

C. Install wall system securely allowing for necessary thermal and structural movement; comply with wall system manufacturer's instructions for installation of concealed fasteners.

D. Do not handle or tool products during erection in manner that damages finish, decreases strength, or results in visual imperfection or failure in performance. Return component parts that require alteration to shop for refabrication, if possible, or for replacement with new parts.

E. Do not form panels in field unless required by wall system manufacturer and approved by the Architect; comply with MCM sheet manufacturer's instructions and recommendations for field forming.

F. Separate dissimilar metals; use gasket fasteners, isolation shims, or isolation tape where needed to eliminate possibility of electrolytic action between metals.

G. Install flashings as indicated on shop drawings. At flashing butt joints, provide a lap strap under flashing and seal lapped surfaces with a full bed of non-hardening sealant.

H. Install square, plumb, straight, and true, accurately fitted, with tight joints and intersections maintaining the following installation tolerances:
   1. Variation From Plane or Location: 1/2 inch in 30 feet of length and up to 3/4 inch in 300 feet, maximum.
   2. Deviation of Vertical Member From True Line: 0.1 inch in 25 feet run, maximum.
   3. Deviation of Horizontal Member From True Line: 0.1 inch in 25 feet run, maximum.
   4. Offset From True Alignment Between Two Adjacent Members Abutting End To End, In Line: 0.03 inch, maximum.

I. Replace damaged products.
   1. Exception: Field repairs of minor damage to finishes are permitted only when approved in writing by Architect, panel manufacturer, and fabricator.
   2. Field Repairs to Finishes: Using materials and methods sufficient that repairs are not discernible when viewed at distance of 10 feet under all typical light conditions experienced at the project.

3.04 CLEANING

A. Ensure weep holes and drainage channels are unobstructed and free of dirt and sealants.

B. Remove protective film after installation of joint sealers, after cleaning of adjacent materials, and immediately prior to completion of work.

C. Remove temporary coverings and protection of adjacent work areas.

D. Clean installed products in accordance with manufacturer's instructions.

3.05 PROTECTION

A. Protect installed panel system from damage until Date of Substantial Completion.

END OF SECTION

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SECTION 07 53 00
ELASTOMERIC MEMBRANE ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Elastomeric roofing membrane, mechanically fastened conventional and adhered conventional application at new addition.

B. Insulation, flat and tapered.

C. Vapor retarder.

D. Cover boards.

E. Roofing cant strips, stack boots, and walkway pads.

1.02 RELATED REQUIREMENTS

A. Section 05 31 00 - Steel Decking: Product requirements for acoustical insulation for deck flutes, for placement by this section.

B. Section 06 10 00 - Rough Carpentry: Wood nailers and curbs.

C. Section 07 62 00 - Sheet Metal Flashing and Trim: Counterflashings, reglets.

D. Section 07 72 00 - Roof Accessories: Roof-mounted units; prefabricated curbs.

1.03 REFERENCE STANDARDS

A. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2017.

B. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2019.

C. ASTM D4637/D4637M - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane; 2015.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.

E. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.

F. FM DS 1-28 - Wind Design; 2016.

G. NRCA (RM) - The NRCA Roofing Manual; 2025.

H. NRCA (WM) - The NRCA Waterproofing Manual; 2021.

I. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all affected installers; review preparation and installation procedures and coordination and scheduling necessary for related work.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating membrane materials, flashing materials, insulation, vapor retarder, surfacing, and fasteners.

C. Shop Drawings: Indicate joint or termination detail conditions, conditions of interface with other materials, setting plan for tapered insulation, and mechanical fastener layout.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Manufacturer's Installation Instructions: Indicate membrane seaming precautions and perimeter conditions requiring special attention.

F. Manufacturer's Field Reports: Indicate procedures followed, ambient temperatures, humidity, wind velocity during application, and supplementary instructions given.

G. Manufacturer's Qualification Statement.

H. Installer's Qualification Statement.

I. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner / Library's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original containers, dry and undamaged, with seals and labels intact.

B. Store materials in weather protected environment, clear of ground and moisture.

C. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.

D. Protect foam insulation from direct exposure to sunlight.

1.08 FIELD CONDITIONS

A. Do not apply roofing membrane during unsuitable weather.

B. Do not apply roofing membrane when ambient temperature is below 40 degrees F or above 95 degrees F.

C. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.

D. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

E. Schedule applications so that no partially completed sections of roof are left exposed at end of workday.

1.09 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Warranty:
   1. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
      a. Special warranty includes membrane roofing, base flashings, roof insulation, fasteners, cover boards, roofing accessories, roof pavers or walkways, and other components of roofing system.
      b. Warranty Period: 20 (twenty) years from date of Substantial Completion.
   2. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering Work of this Section, including all components of roofing system such as membrane roofing, base flashing, roof insulation, fasteners, cover boards, vapor retarders, roof pavers, and walkway products, for the following warranty period:
      a. Warranty Period: Two years from date of Substantial Completion

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. EPDM Membrane Materials:

1. Carlisle Roofing Systems, Inc: www.carlisle-syntec.com/#sle.
2. Elevate, a brand of Holcim Building Envelope – formerly Firestone Building Products : https://www.holcimelevate.com/us-en.
3. GenFlex Roofing Systems, LLC: www.genflex.com/#sle.
4. Johns Manville: www.jm.com/#sle.
5. Mule-Hide Products: www.mulehide.com/#sle
6. Versico Roofing Systems: www.versico.com/#sle.
7. Or approved equal.

2.02 ROOFING - UNBALLASTED APPLICATIONS

A. Elastomeric Membrane Roofing: One ply membrane, fully adhered, over vapor retarder and insulation. Insulation to be mechnically fastened.

B. Roofing Assembly Requirements:
   1. Roof Covering External Fire Resistance Classification: UL (DIR) certified Class A.
   2. Insulation Thermal Resistance (R-Value): 5 per inch, minimum; provide insulation of thickness required. **Average Roof Insulation value to be at least R-30.**

C. Acceptable Insulation Types - Constant Thickness Application: Any type that meets requirements and is approved by membrane manufacturer for application.
   1. Bottom layer of polyisocyanurate board covered with required layers of polyisocyanurate board to achieve R-Value required.

D. Acceptable Insulation Types - Tapered Application: Any of the types specified.
   1. Tapered polyisocyanurate board.

2.03 ROOFING MEMBRANE AND ASSOCIATED MATERIALS

A. Membrane: Ethylene-propylene-diene-monomer (EPDM); internally reinforced with fabric or scrim; complying with minimum properties of ASTM D4637/D4637M.
   1. Thickness: 0.060 inch (60 mil).
   2. Sheet Width: 76 inch, minimum; factory-fabricate into largest sheets possible.
   3. Solar Reflectance: 0.75, minimum, initial, and 0.64, minimum, 3-year, certified by Cool Roof Rating Council.
   4. Thermal Emittance: 0.84, minimum, initial, and 0.87, minimum, 3-year, certified by Cool Roof Rating Council.
   5. Color: White.

B. Seaming Materials: As recommended by membrane manufacturer.

C. Vapor Retarder: Plastic, complying with requirements of fire rating classification; compatible with roofing and insulation materials. Polyethelene film, 10 mils, 0.076 perms, to meet ASTM D4397.
   1. Fire-retardant adhesive.

D. Flexible Flashing Material: Same material as membrane.
   1. Thickness: 45 mil.
   2. Tensile Strength: 1,200 psi.
   3. Elasticity: 50 percent with full recovery without set.
   4. Color: White.

2.04 COVER BOARDS

A. Cover Boards: Glass-mat faced gypsum panels complying with ASTM C1177/C1177M.
   1. Thickness: 1/2 inch, fire-resistant.
   2. Manufacturers:
      a. Georgia-Pacific: www.densdeck.com/#sle.
      b. Or approved equal.
      c. Surface Water Absorption: 2.5 g, maximum, when tested in accordance with ASTM C473.

d. Surface Burning Characteristics: Flame spread index of 0 (zero), smoke developed index of 0 (zero), when tested in accordance with ASTM E84.
e. Combustibility: Non-combustible, when tested in accordance with ASTM E136.
f. Mold Growth Resistance: Zero growth, when tested in accordance with ASTM D3273 for minimum of 4 weeks.

2.05 INSULATION

A. Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam, complying with ASTM C1289.
1. Classifications:
a. Type II:
1) Class 1 - Faced with glass fiber reinforced cellulosic felt facers on both major surfaces of core foam.
2) Compressive Strength: Classes 1-2-3, Grade 2 - 20 psi (138 kPa), minimum.
3) Thermal Resistance, R-value: At 1-1/2 inch thick; Class 1, Grades 1-2-3 - 8.4 (1.48) at 75 degrees F.
2. Board Size: 48 by 96 inch.
3. Board Thickness: 1.5 inch in multiple layers to achieve R-Value required.
4. Tapered Board: Slope as indicated; minimum thickness 1.5 inch; fabricate of fewest layers possible.
5. Board Edges: Square.

2.06 ACCESSORIES

A. Stack Boots: Prefabricated flexible boot and collar for pipe stacks through membrane; same material as membrane.

B. Cant and Edge Strips: Wood fiberboard, compatible with roofing materials ; cants formed to 45 degree angle.

C. Insulation Fasteners: Appropriate for purpose intended.
1. Length as required for thickness of insulation material and penetration of deck substrate, with metal washers.

D. Membrane Adhesive: As recommended by membrane manufacturer.

E. Surface Conditioner for Adhesives: Compatible with membrane and adhesives.

F. Thinners and Cleaners: As recommended by adhesive manufacturer, compatible with membrane.

G. Insulation Adhesive: As recommended by insulation manufacturer.

H. Roofing Nails: Galvanized, hot-dipped type, size and configuration as required to suit application.

I. Strip Reglet Devices: Galvanized steel, maximum possible lengths per location, with attachment flanges.

J. Insulation Perimeter Restraint: Stainless steel edge device configured to restrain insulation boards in position and provide top flashing over ballast.

K. Sealants: As recommended by membrane manufacturer.

L. Walkway Pads: Suitable for maintenance traffic, contrasting color or otherwise visually distinctive from roof membrane.
1. Composition: Asphaltic with mineral granule surface or Roofing membrane manufacturer's standard.
2. Size: Manufacturer's standard size(s).
3. Adhere to the roofing membrane, spacing each pad at a minimum of 1.0 inch and maximum of 3.0 inches from each other to allow for drainage.
a. If installation of walkway pads over field fabricated splices or within 6 inches of a splice edge cannot be avoided, adhere another layer of flashing over the splice and extend beyond walkway pad a minimum of 6 inches on either side.

4. Locate additional walkway pad under each concrete splash pad on roof, 1 locations.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and site conditions are ready to receive work.

B. Verify deck is supported and secure.

C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.

D. Verify deck surfaces are dry and free of snow or ice.

E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and cant strips are in place.

3.02 INSTALLATION - VAPOR RETARDER AND INSULATION, UNDER MEMBRANE

A. Install vapor retarder to deck surface with adhesive in accordance with manufacturer's instructions.
   1. Extend vapor retarder under cant strips and blocking to deck edge.
   2. Install flexible flashing from vapor retarder to air seal material of wall construction, lap and seal to provide continuity of the air barrier plane.

B. Ensure vapor retarder is clean and dry, continuous, and ready for application of insulation.

C. Attachment of Insulation:
   1. Mechanically fasten insulation to deck in accordance with roofing manufacturer's instructions.

D. Cover Boards: Mechanically fasten cover boards in accordance with roofing manufacturer's instructions.

E. Lay subsequent layers of insulation with joints staggered minimum 6 inch from joints of preceding layer.

F. Place tapered insulation to the required slope pattern in accordance with manufacturer's instructions.

G. On metal deck, place boards perpendicular to flutes with insulation board edges bearing on deck flutes.

H. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.

I. Do not apply more insulation than can be covered with membrane in same day.

3.03 INSTALLATION - MEMBRANE

A. Install elastomeric membrane roofing system in accordance with manufacturer's recommendations and NRCA (WM) applicable requirements.

B. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.

C. Shingle joints on sloped substrate in direction of drainage.

D. Fully Adhered Application: Apply adhesive to substrate at rate of manufacturer's required gal/square. Fully embed membrane in adhesive except in areas directly over or within 3 inches of expansion joints. Fully adhere one roll before proceeding to adjacent rolls.

E. Overlap edges and ends and seal seams by contact adhesive, minimum 3 inches. Seal permanently waterproof. Apply uniform bead of sealant to joint edge.

F. At intersections with vertical surfaces:
   1. Extend membrane over cant strips and up a minimum of 4 inches onto vertical surfaces.
   2. Fully adhere flexible flashing over membrane and up to nailing strips.
   3. Insert flashing into reglets and secure.

G. Around roof penetrations, seal flanges and flashings with flexible flashing.

H. Coordinate installation of roof drains and sumps and related flashings.

I. Coordinate installation of associated counterflashings installed under other sections.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for general requirements for field quality control and inspection.

3.05 CLEANING

A. Remove bituminous markings from finished surfaces.

B. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and comply with their documented instructions.

C. Repair or replace defaced or damaged finishes caused by work of this section.

3.06 PROTECTION

A. Protect installed roofing and flashings from construction operations.

B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

END OF SECTION

SECTION 07 62 00
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fabricated sheet metal items, including flashings, counterflashings, gutters, downspouts, sheet metal roofing, exterior penetrations, and gravel stops and metal cornice.

B. Sealants for joints within sheet metal fabrications.

C. Precast concrete splash pads.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Wood nailers for sheet metal work.

B. Section 06 10 00 - Rough Carpentry: Field fabricated roof curbs.

C. Section 07 71 00 - Roof Specialties: Manufactured copings, flashings, and expansion joint covers.

D. Section 07 72 00 - Roof Accessories: Manufactured metal roof curbs.

E. Section 07 92 00 - Joint Sealants: Sealing non-lap joints between sheet metal fabrications and adjacent construction.

1.03 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2017a.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.

C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

E. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2018).

F. CDA A4050 - Copper in Architecture - Handbook; current edition.

G. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

C. Samples: Submit two samples 4 by 4 inch in size illustrating metal finish color.

1.06 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with 5 years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.01 SHEET MATERIALS

A. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24 gage, (0.0239) inch thick base metal, shop pre-coated with PVDF coating.
   1. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.
   2. Color: As selected by Architect from manufacturer's standard colors.

B. Stainless Steel: ASTM A666, Type 304 alloy, soft temper, 28 gage, (0.0156 inch) thick; smooth No. 4 - Brushed finish.

2.02 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Form pieces in longest possible lengths.
   1. Center layout on all walls and openings so installation is balanced.

C. Hem exposed edges on underside 1/2 inch; miter and seam corners.

D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

E. Fabricate corners from one piece with minimum 24 inch long legs; seam for rigidity, seal with sealant.
   1. Center layout on all walls and openings so installation is balanced, alter as needed to meet corner minimum lengths.

F. Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with interlocking counterflashing on exterior face, of same metal as reglet.
   1. Material: 0.024 inch thick
   2. Accessories:
      a. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.

G. Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.
   1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
   2. Obtain field measurements for accurate fit before shop fabrication.
   3. Form sheet metal flashing and trim without oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
   4. Conceal fasteners and expansion provisions where possible with sheet metal caps. Exposed fasteners are not allowed on faces exposed to view.

H. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.

I. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.

J. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

K. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.

L. Do not use graphite pencils to mark metal surfaces.

M. Roof-Edge Flashing and Fascia: Fabricate in minimum 96-inch- long, but not exceeding 10-foot- long, sections. Where wall dimension is less than 18'-0" in length, fabricate two sections of equal length to allow for the joint to be centered on the wall.
   1. Joint Style: Butt, with 12-inch- wide, concealed backup plate sealed on one side to below.

N. Construction per SMACNA's "Architectural Sheet Metal Manual." 2003 Edition:
   1. Roof Edge: Fig 2-1A
   2. Joints between fascia and soffit: Fig C-3
   3. Coping at Mechanical Screen Wall: Fig 3-4A
   4. Coping at Masonry Expansion Joint: Fig 3-4A
   5. Spring Counter Flashing: Fig 4-4C

2.03 GUTTER AND DOWNSPOUT FABRICATION

A. Gutters: SMACNA (ASMM) Rectangular profile.

B. Downspouts: Rectangular profile.
   1. 6 inch by 6 inch, typical, unless noted otherwise.

C. Accessories: Profiled to suit gutters and downspouts.
   1. Anchorage Devices: In accordance with SMACNA (ASMM) requirements.
   2. Downspout Supports: Brackets.

D. Splash Pads: Precast concrete type, of size and profiles indicated; minimum 3000 psi at 28 days, with minimum 5 percent air entrainment.

E. Downspout Extenders: Same material and finish as downspouts.

F. **Seal metal joints with self-adjered EPDM roofing membrane patches**.

G. Downspouts: Fabricate rectangular closed-face downspouts to dimensions indicated, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors. Shop fabricate elbows.

2.04 ACCESSORIES

A. Fasteners: Stainless steel.

B. Primer: Zinc chromate type.

C. Concealed Sealants: Non-curing butyl sealant.

D. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.

E. Plastic Cement: ASTM D4586/D4586M, Type I.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Install surface mounted reglets true to lines and levels, and seal top of reglets with sealant.

C. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

3.03 INSTALLATION

A. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..

B. Apply plastic cement compound between metal flashings and felt flashings.

C. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

D. Secure gutters and downspouts in place with concealed fasteners.

E. Set splash pads under downspouts.

F. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
   1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
   2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
   3. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
   4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
   5. Install sealant tape where indicated.
   6. Torch cutting of sheet metal flashing and trim is not permitted.

G. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.

H. Fastener Sizes: Use fasteners of sizes that will penetrate wood sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.

I. Seal joints as shown and as required for watertight construction.
   1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
   2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

J. Install sheet metal roof-drainage items to produce complete roof-drainage system according to cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.
   1. Downspouts: Join sections with 1-1/2-inch telescoping joints.
      a. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches o.c.
      b. Provide elbows at base of downspout to direct water away from building.
   2. Parapet Scuppers/Conductor Head: Continuously support scupper/conductor head, set to correct elevation, and seal flanges to interior wall face, and under roofing membrane.
      a. Anchor scupper/conductor head closure trim flange to exterior wall and seal with elastomeric sealant.
      b. Seal with elastomeric sealant.

K. Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

L. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in SMACNA's "Architectural Sheet Metal Manual" and as indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.

M. Copings: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.
   1. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 24-inch centers.
   2. Anchor interior leg of coping with screw fasteners and washers at 24-inch centers.

N. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.

O. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints a minimum of 4 inches and bed with sealant. Secure in a waterproof manner by means of snap-in installation and sealant or lead wedges and sealant.

P. Slope gutters 1/4 inch per 10 feet, minimum.

3.04 CLEANING

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean off excess sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, remove unused materials and clean finished surfaces. Maintain in a clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

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SECTION 07 72 00
ROOF ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Curbs.

B. Equipment rails.

C. Roof penetrations mounting curbs.

D. Roof hatches.

E. Non-penetrating pedestals.

F. Snow guards.

1.02 RELATED REQUIREMENTS

A. Section 05 31 00 - Steel Decking.

B. Section 07 62 00 - Sheet Metal Flashing and Trim: Roof accessory items fabricated from sheet metal.

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

C. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used.
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. Maintenance requirements.

C. Shop Drawings: Submit detailed layout developed for this project and provide dimensioned location and number for each type of roof accessory.
   1. Snow Guards: Submit design calculations for loadings and spacings based on manufacturer testing.
   2. Submit shop drawings sealed and signed by a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

D. Warranty Documentation:
   1. Submit manufacturer warranty.
   2. Ensure that forms have been completed in Owner / Library's name and registered with manufacturer.
   3. Submit documentation that roof accessories are acceptable to roofing manufacturer, and do not limit the roofing warranty.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store products under cover and elevated above grade.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide five year manufacturer warranty for Roof Hatches and Snow Guards.
   1. Provide 20 year finish warranty.

PART 2 PRODUCTS

2.01 ROOF CURBS

A. Roof Curbs Mounting Assemblies: Factory fabricated hollow sheet metal construction, internally reinforced, and capable of supporting superimposed live and dead loads and designated equipment load with fully mitered and sealed corner joints welded or mechanically fastened, and integral counterflashing with top and edges formed to shed water.
   1. Roof Curb Mounting Substrate: Curb substrate consists of corrugated metal roof deck with insulation.
   2. Sheet Metal Material:
      a. Aluminum: 0.080 inch minimum thickness, with 3003 alloy, and H14 temper.
         1) Color: As selected by Architect from manufacturer's standard line of colors.
   3. Provide layouts and configurations indicated on drawings.

B. Equipment Rail Curbs: Straight curbs on each side of equipment, with top of curbs horizontal and level with each other for equipment mounting.
   1. Provide preservative treated wood nailers along top of rails.
   2. Height Above Finished Roof Surface: 8 inches, minimum.
   3. Height Above Roof Deck: 14 inches, minimum.

C. Pipe, Duct, or Conduit Mounting Curbs: Vertical posts, minimum 8 inches square unless otherwise indicated.

2.02 ROOF HATCHES AND VENTS

A. Roof Hatch Manufacturers:
   1. AES Industries, Inc.
   2. Babcock-Davis; ThermalMAX: www.babcockdavis.com/#sle.
   3. Custom Solution Roof and Metal Products.
   4. JL Industries, Inc.; a division of the Activar Construction Products Group.
   5. Metallic Products Corp.

B. Frames and Curbs: One-piece curb and frame with integral cap flashing to receive roof flashings; extended bottom flange to suit mounting.
   1. Finish: Factory paint.
   2. Insulation: Manufacturer's standard; 1 inch rigid glass fiber, located on outside face of curb.
   3. Curb Height: 12 inches from surface of roof deck, minimum.

C. Metal Covers: Flush, insulated, hollow metal construction.
   1. Capable of supporting 40 psf live load.
   2. Finish: Factory paint.
   3. Insulation: Manufacturer's standard 1 inch rigid glass fiber.
   4. Gasket: Neoprene, continuous around cover perimeter.

D. Hardware: Steel, zinc coated and chromate sealed, unless otherwise indicated or required by manufacturer.
   1. Lifting Mechanisms: Compression or torsion spring operator with shock absorbers that automatically opens upon release of latch; capable of lifting covers despite 10 psf load.
   2. Hinges: Heavy duty pintle type.
   3. Hold open arm with vinyl-coated handle for manual release.
   4. Latch: Upon closing, engage latch automatically and reset manual release.
   5. Manual Release: Pull handle on interior.
   6. Locking: Padlock hasp on interior.

2.03 NON-PENETRATING ROOFTOP SUPPORTS/ASSEMBLIES

A. Non-Penetrating Rooftop Support/Assemblies: Manufacturer-engineered and factory-fabricated, with pedestal bases that rest on top of roofing membrane, and not requiring any attachment to roof structure and not penetrating roofing assembly.
   1. Design Loadings and Configurations: As required by applicable codes.
   2. Height: Provide minimum clearance of 6 inches under supported items to top of roofing.
   3. Support Spacing and Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
   4. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
   5. Hardware, Bolts, Nuts, and Washers: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A153/A153M.

B. Pipe Supports: Provide attachment fixtures complying with MSS SP-58 and as indicated.
   1. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports; corrosion resistant material.

C. Duct Supports: Provide extruded aluminum supports and sized in accordance with diameter of supported ducts, and with base that is non-penetrating of roofing membrane.

D. Non-Penetrating Pedestals: Steel pedestals with square, round, or rectangular bases.
   1. Bases: High density polypropylene.
   2. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
   3. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.

2.04 SNOW GUARDS

A. Rail-Mouted, Rail-Type Snow Guard: Continuous snow guard; manufacturer's standard dual pipe, set in brackets or posts, with optional plates and metal trim to match roof.
   1. Brackets: Aluminum, Powder Coated.
   2. Pipe or Square Tube: Aluminum, Powder Coated.
      a. Outside Diameter, Round: 1 inch, nominal.
   3. Supplemental Plates and Clips: Attached to horizontal component; match finish of pipe, tube, rod, or channel.
      a. Provide snow clips on bottom rail.
   4. Bracket Base Plate: Shaped to fit roof tile, with integral sealant pocket and factory applied sealant; Stainless Steel base plate.
   5. Basis of Design:
      a. Model #225 Two pipe adjustable snow guard as manufactured by Alpine Snowguards, a division of Vermont Slate & Copper Services.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using methods recommended by manufacturer for achieving acceptable results for applicable substrate under project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions, in manner that maintains roofing system weather-tight integrity.

3.04 CLEANING

A. Clean installed work to like-new condition.

3.05 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 07 84 00
FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Firestopping systems.

B. Firestopping of joints and penetrations in fire resistance rated and smoke resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.02 RELATED REQUIREMENTS

A. Section 07 05 53 - Fire and Smoke Assembly Identification.

B. Section 09 21 16 - Gypsum Board Assemblies: Gypsum wallboard fireproofing.

1.03 REFERENCE STANDARDS

A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a (Reapproved 2017).

B. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems; 2015 (Reapproved 2019).

C. ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus; 2020.

D. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed Between Rated Wall Assemblies and Nonrated Horizontal Assemblies; 2013 (Reapproved 2017).

E. ITS (DIR) - Directory of Listed Products; Current Edition.

F. FM 4991 - Approval Standard for Firestop Contractors; 2013.

G. FM (AG) - FM Approval Guide; current edition.

H. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.

I. UL (DIR) - Online Certifications Directory; Current Edition.

J. UL (FRD) - Fire Resistance Directory; Current Edition.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.

C. Product Data: Provide data on product characteristics, performance ratings, and limitations.

D. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
   1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.
   2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org will be considered as constituting an acceptable test report.
   3. Submission of actual test reports is required for assemblies for which none of the above substantiation exists.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section and:
   1. Trained by manufacturer.
   2. Verification of minimum three years documented experience installing work of this type.

1.06 FIELD CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.

B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Firestopping Manufacturers:
   1. A/D Fire Protection Systems Inc: www.adfire.com/#sle.
   2. Everkem Diversified Products, Inc: www.everkemproducts.com/#sle.
   3. Grabber Construction Products, Inc: www.grabberman.com/#sle.
   4. Hilti, Inc: www.us.hilti.com/#sle.
   5. HoldRite, a Brand of Reliance Worldwide Corporation: www.holdrite.com/#sle.
   6. Nelson FireStop Products: www.nelsonfirestop.com/#sle.
   7. Passive Fire Protection Partners: www.firestop.com/#sle.
   8. Specified Technologies Inc: www.stifirestop.com/#sle.
   9. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
   10. Or approved equal.

2.02 MATERIALS

A. Firestopping Materials: Any materials meeting requirements.

B. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

2.03 FIRESTOPPING ASSEMBLY REQUIREMENTS

A. Perimeter Fire Containment Firestopping: Use system that has been tested according to ASTM E2307 to have fire resistance F Rating equal to required fire rating of floor assembly.
   1. Movement: Provide systems that have been tested to show movement capability as indicated.
   2. Temperature Rise: Provide systems that have been tested to show T Rating as indicated.
   3. Air Leakage: Provide systems that have been tested to show L Rating as indicated.

B. Head-of-Wall Joint System Firestopping at Joints Between Fire-Rated Wall Assemblies and Non-Rated Horizontal Assemblies: Use system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of floor or wall, whichever is greater.
   1. Movement: Provide systems that have been tested to show movement capability as indicated.

C. Floor-to-Floor, Wall-to-Wall, and Wall-to-Floor Joints, Except Perimeter, Where Both Are Fire-Rated: Use system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.
   1. Movement: Provide systems that have been tested to show movement capability as indicated.
   2. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
   3. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.

D. Through Penetration Firestopping: Use system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.
   1. Temperature Rise: Provide systems that have been tested to show T Rating as indicated.

2. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
3. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.

E. Where multiple products are listed in the same sub-section, contractor's option to use any of the approved products or comparable products from one of the approved manufacturers listed above. All products provided are to be provided by one manufacturer.

2.04 FIRESTOPPING FOR FLOOR-TO-FLOOR, WALL-TO-FLOOR, AND WALL-TO-WALL JOINTS

A. Gypsum Board Walls:
1. Wall to Wall Joints That Have Movement Capabilities (Dynamic):
   a. 1 Hour Construction: UL System WW-D-0067; Hilti CP 606 Flexible Firestop Sealant.
2. Top of Wall Joints at Concrete Over Metal Deck:
   a. 1 Hour Construction: UL System HW-D-0034; Specified Technologies Inc. ES Elastomeric Firestop Sealant.
3. Top of Wall Joints at Concrete Over Metal Deck, Wall Parallel to Ribs:
   a. 1 Hour Construction: UL System HW-D-0184; Hilti CP 606 Flexible Firestop Sealant.
4. Top of Wall Joints at Concrete Over Metal Deck, Wall Perpendicular to Ribs, Cut to Fit Ribs:
   a. 1 Hour Construction: UL System HW-D-0045; Hilti CP 606 Flexible Firestop Sealant.
5. Top of Wall Joints at Concrete Over Metal Deck, Wall Perpendicular to Ribs, Not Cut to Fit:
   a. 1 Hour Construction: UL System HW-D-0045; Hilti CP 606 Flexible Firestop Sealant.

2.05 FIRESTOPPING PENETRATIONS THROUGH CONCRETE AND CONCRETE MASONRY CONSTRUCTION

A. Penetrations Through Walls By:
1. Uninsulated Metallic Pipe, Conduit, and Tubing:
   a. 1 Hour Construction: UL System W-J-1067; Hilti FS-ONE MAX Intumescent Firestop Sealant.
2. Insulated Pipes:
   a. 1 Hour Construction: UL System C-AJ-5090; Hilti FS-ONE MAX Intumescent Firestop Sealant.

2.06 FIRESTOPPING PENETRATIONS THROUGH GYPSUM BOARD WALLS

A. Blank Openings:
1. 1 Hour Construction: UL System W-L-0032; Specified Technologies Inc. FP Intumescent Firestop Plug.
2. 1 Hour Construction: UL System W-L-0038; Specified Technologies Inc. FP Intumescent Firestop Plug.

B. Penetrations By:
1. Multiple Penetrations in Large Openings:
   a. 1 Hour Construction: UL System W-L-8013; Hilti CFS-BL Firestop Block.
   b. 1 Hour Construction: UL System W-L-8025; Specified Technologies Inc. LCI Intumescent Firestop Sealant.
   c. 1 Hour Construction: UL System W-L-8050; Specified Technologies Inc. SSB Intumescent Firestop pillows.
   d. 1 Hour Construction: UL System W-L-8071; Hilti FS-ONE MAX Intumescent Firestop Sealant.
   e. 1 Hour Construction: UL System W-L-8079; Hilti FS-ONE MAX Intumescent Firestop Sealant.
2. Uninsulated Metallic Pipe, Conduit, and Tubing:
   a. 1 Hour Construction: UL System W-L-1049; Specified Technologies Inc. SSS Intumescent Firestop Sealant.

b. 1 Hour Construction: UL System W-L-1054; Hilti FS-ONE MAX Intumescent Firestop Sealant.
c. 1 Hour Construction: UL System W-L-1090; Specified Technologies Inc. LC Endothermic Firestop Sealant.
d. 1 Hour Construction: UL System W-L-1164; Hilti FS-ONE MAX Intumescent Firestop Sealant.
e. 1 Hour Construction: UL System W-L-1222; Specified Technologies Inc. LCI Intumescent Firestop Sealant.
f. 1 Hour Construction: UL System W-L-1477; Specified Technologies Inc. EZ Firestop Grommet.
g. 1 Hour Construction: UL System W-L-1506; Hilti CFS-D Firestop Cable Disc.

3. Uninsulated Non-Metallic Pipe, Conduit, and Tubing:
   a. 1 Hour Construction: UL System W-L-2074; Specified Technologies Inc. SSC collars.
   b. 1 Hour Construction: UL System W-L-2078; Hilti CP 643N/644 Firestop Collar.
   c. 1 Hour Construction: UL System W-L-2128; Hilti FS-ONE MAX Intumescent Firestop Sealant.
   d. 1 Hour Construction: UL System W-L-2237; Specified Technologies Inc. LCC Intumescent Firestop Collars.
   e. 1 Hour Construction: UL System W-L-2241; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (for wood frame construction).
   f. 1 Hour Construction: UL System W-L-2243; Specified Technologies Inc. SSW wrap strips.
   g. 1 Hour Construction: UL System W-L-2493; Specified Technologies Inc. RTC range-taking collar.
4. Electrical Cables Not In Conduit:
   a. 1 Hour Construction: UL System W-L-3024; Specified Technologies Inc. SSP Firestop Putty.
   b. 1 Hour Construction: UL System W-L-3065; Hilti FS-ONE MAX Intumescent Firestop Sealant, CP 606 Flexible Firestop Sealant, CD 601S Elastomeric Firestop Sealant, or CP 618 Firestop Putty Stick.
   c. 1 Hour Construction: UL System W-L-3084; Specified Technologies Inc. SSB Intumescent Firestop pillows.
   d. 1 Hour Construction: UL System W-L-3135; Specified Technologies Inc. SSP Firestop Putty.
   e. 1 Hour Construction: UL System W-L-3169; Specified Technologies Inc. LCI Intumescent Firestop Sealant.
   f. 1 Hour Construction: UL System W-L-3218; Specified Technologies Inc. EZ-Path Series 33 Fire-Rated Pathway.
   g. 1 Hour Construction: UL System W-L-3255; Specified Technologies Inc. EZ-Path Series 22 Fire-Rated Pathway.
   h. 1 Hour Construction: UL System W-L-3256; Specified Technologies Inc. EZ-Path Series 22 Fire-Rated Pathway.
   i. 1 Hour Construction: UL System W-L-3265; Specified Technologies Inc. EZ-Path Series 33 Fire-Rated Pathway.
   j. 1 Hour Construction: UL System W-L-3303; Specified Technologies Inc. Ready Split Sleeve.
   k. 1 Hour Construction: UL System W-L-3306; Specified Technologies Inc. EZ-Path Series 44 Fire-Rated Pathway.
   l. 1 Hour Construction: UL System W-L-3334; Hilti CP 653 Speed Sleeve.
   m. 1 Hour Construction: UL System W-L-3350; Specified Technologies Inc. LC Endothermic Firestop Sealant.
   n. 1 Hour Construction: UL System W-L-3357; Specified Technologies Inc. FP Intumescent Firestop Plug.

o. 1 Hour Construction: UL System W-L-3358; Specified Technologies Inc. Ready Split Sleeve.
p. 1 Hour Construction: UL System W-L-3358; Specified Technologies Inc. Ready-Sleeve.
q. 1 Hour Construction: UL System W-L-3369; Specified Technologies Inc. EZ Firestop Grommet.
r. 1 Hour Construction: UL System W-L-3370; Specified Technologies Inc. EZ Firestop Grommet.
s. 1 Hour Construction: UL System W-L-3374; Specified Technologies Inc. FP Intumescent Firestop Plug.
t. 1 Hour Construction: UL System W-L-3376; Specified Technologies Inc. Ready-Sleeve.
u. 1 Hour Construction: UL System W-L-3377; Specified Technologies Inc. EZ-Path Series 22 Fire-Rated Pathway.
v. 1 Hour Construction: UL System W-L-3377; Specified Technologies Inc. EZ-Path Series 33 Fire-Rated Pathway.
w. 1 Hour Construction: UL System W-L-3378; Specified Technologies Inc. EZ Firestop Grommet.
x. 1 Hour Construction: UL System W-L-3379; Specified Technologies Inc. EZ Firestop Grommet.
y. 1 Hour Construction: UL System W-L-3390; Specified Technologies Inc. EZ-Path Series 44 Fire-Rated Pathway.
z. 1 Hour Construction: UL System W-L-3393; Hilti CFS-SL RK Retrofit Sleeve Kit for existing cables.
aa. 1 Hour Construction: UL System W-L-3414; Hilti CFS-D Firestop Cable Disc.

5. Cable Trays with Electrical Cables:
   a. 1 Hour Construction: UL System W-L-4011; Hilti CFS-BL Firestop Block.
   b. 1 Hour Construction: UL System W-L-4060; Hilti FS-ONE MAX Intumescent Firestop Sealant.
6. Insulated Pipes:
   a. 1 Hour Construction: UL System W-L-5014; Specified Technologies Inc. SSS Intumescent Firestop Sealant.
   b. 1 Hour Construction: UL System W-L-5028; Hilti FS-ONE MAX Intumescent Firestop Sealant.
   c. 1 Hour Construction: UL System W-L-5029; Hilti FS-ONE Intumescent Firestop Sealant.
   d. 1 Hour Construction: UL System W-L-5121; Specified Technologies Inc. LCI Intumescent Firestop Sealant.
   e. 1 Hour Construction: UL System W-L-5273; Specified Technologies Inc. LC Endothermic Firestop Sealant.
   f. 1 Hour Construction: UL System W-L-5298; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (for wood frame construction).
7. HVAC Ducts, Insulated:
   a. 1 Hour Construction: UL System W-L-7164; Specified Technologies Inc. FyreFlange HVAC Firestop Angle.
   b. 1 Hour Construction: UL System W-L-7238; Specified Technologies Inc. FyreFlange HVAC Firestop Angle.
   c. 1 Hour Construction: UL System W-L-7156; Hilti FS-ONE MAX Intumescent Firestop Sealant.

2.07 FIRESTOPPING SYSTEMS

A. Firestopping: Any material meeting requirements.
   1. Fire Ratings: See drawings for required systems and ratings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify openings are ready to receive the work of this section.

3.02 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.

B. Remove incompatible materials that could adversely affect bond.

C. Install backing materials to prevent liquid material from leakage.

3.03 INSTALLATION

A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

B. Do not cover installed firestopping until inspected by Owner / Library's Independent Testing Agency.

C. Do not cover installed firestopping until inspected by authorities having jurisdiction.

D. Install labeling required by code.

3.04 FIELD QUALITY CONTROL

A. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.

3.05 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.06 PROTECTION

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 07 92 00
JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nonsag gunnable joint sealants.

B. Self-leveling pourable joint sealants.

C. Joint backings and accessories.

1.02 RELATED REQUIREMENTS

A. Section 08 71 00 - Door Hardware: Setting exterior door thresholds in sealant.

B. Section 09 21 16 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.

C. Section 09 22 16 - Non-Structural Metal Framing: Sealing between framing and adjacent construction in acoustical and sound-rated walls and ceilings.

D. Section 09 30 00 - Tiling: Sealant between tile and plumbing fixtures and at junctions with other materials and changes in plane.

E. Section 23 31 00 - HVAC Ducts and Casings: Duct sealants.

1.03 REFERENCE STANDARDS

A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer; 2015.

B. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2018.

C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

D. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.

E. ASTM C1311 - Standard Specification for Solvent Release Sealants; 2014.

F. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants; 2018.

G. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints; 2019.

H. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2015, with Editorial Revision (2017).

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
   1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
   2. List of backing materials approved for use with the specific product.
   3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
   4. Substrates the product should not be used on.
   5. Substrates for which use of primer is required.

C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.

D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

E. Installation Plan: Submit at least four weeks prior to start of installation.

F. Preinstallation Field Adhesion Test Plan: Submit at least two weeks prior to start of installation.

G. Preinstallation Field Adhesion Test Reports: Submit filled out Preinstallation Field Adhesion Test Reports log within 10 days after completion of tests; include bagged test samples and photographic records.

H. Installation Log: Submit filled out log for each length or instance of sealant installed.
   1. Joint-Sealant Schedule: Include the following information:
      a. Joint-sealant application, joint location, and designation.
      b. Joint-sealant manufacturer and product name.
      c. Joint-sealant color.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of documented experience.

C. Preinstallation Field Adhesion Test Plan: Include destructive field adhesion testing of one sample of each combination of sealant type and substrate, except interior acrylic latex sealants, and include the following for each tested sample.
   1. Identification of testing agency.
   2. Preinstallation Field Adhesion Test Log Form: Include the following data fields, with known information filled out.
      a. Test date.
      b. Copy of test method documents.
      c. Age of sealant upon date of testing.
      d. Test results, modeled after the sample form in the test method document.
      e. Indicate use of photographic record of test.

D. Field Adhesion Test Procedures:
   1. Allow sealants to fully cure as recommended by manufacturer before testing.
   2. Have a copy of the test method document available during tests.
   3. Record the type of failure that occurred, other information required by test method, and the information required on the Field Quality Control Log.
   4. When performing destructive tests, also inspect the opened joint for proper installation characteristics recommended by manufacturer, and report any deficiencies.
   5. Deliver the samples removed during destructive tests in separate sealed plastic bags, identified with project, location, test date, and test results, to Owner / Library.
   6. If any combination of sealant type and substrate does not show evidence of minimum adhesion or shows cohesion failure before minimum adhesion, report results to Architect.

E. Destructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Destructive Tail Procedure.
   1. Sample: At least 18 inches long.
   2. Minimum Elongation Without Adhesive Failure: Consider the tail at rest, not under any elongation stress; multiply the stated movement capability of the sealant in percent by two; then multiply 1 inch by that percentage; if adhesion failure occurs before the "1 inch mark" is that distance from the substrate, the test has failed.
   3. If either adhesive or cohesive failure occurs prior to minimum elongation, take necessary measures to correct conditions and re-test; record each modification to products or installation procedures.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective work within a five year period after Date of Substantial Completion.

C. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal , exhibit loss of adhesion or cohesion, or do not cure.

D. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: 20 years from date of Final Acceptance for weatherseal and non-staining of silicone sealants.

E. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
   1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
   2. Disintegration of joint substrates from natural causes exceeding design specifications.
   3. Mechanical damage caused by individuals, tools, or other outside agents.
   4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

F. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Non-Sag Sealants: Permits application in joints on vertical surfaces without sagging or slumping.
   1. Bostik Inc: www.bostik-us.com/#sle.
   2. Dow Chemical Company: consumer.dow.com/en-us/industry/ind-building-construction.html/#sle.
   3. Fortifiber Building Systems Group: www.fortifiber.com/#sle.
   4. Hilti, Inc: www.us.hilti.com/#sle.
   5. Pecora Corporation: www.pecora.com/#sle.
   6. Sika Corporation: www.usa-sika.com/#sle.
   7. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
   8. W.R. Meadows, Inc: www.wrmeadows.com/#sle.
   9. Or approved equal.

B. Self-Leveling Sealants: Pourable or self-leveling sealant that has sufficient flow to form a smooth, level surface when applied in a horizontal joint.
   1. Bostik Inc: www.bostik-us.com/#sle.
   2. Pecora Corporation: www.pecora.com/#sle.
   3. Sika Corporation: www.usa-sika.com/#sle.
   4. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
   5. W.R. Meadows, Inc: www.wrmeadows.com/#sle.
   6. Or approved equal.

2.02 JOINT SEALANT APPLICATIONS

A. Scope:
   1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.
      a. Wall expansion and control joints.
      b. Joints between door, window, and other frames and adjacent construction.
      c. Joints between different exposed materials.
      d. Openings below ledge angles in masonry.
      e. Other joints indicated below.

2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
   a. Joints between door, window, and other frames and adjacent construction.
   b. In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, piping, and other openings; between wall/ceiling and other construction; and other flanking sound paths.
   c. Other joints indicated below.
3. Do not seal the following types of joints.
   a. Intentional weepholes in masonry.
   b. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
   c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
   d. Joints where installation of sealant is specified in another section.
   e. Joints between suspended panel ceilings/grid and walls.

B. Exterior Joints: Use non-sag non-staining silicone sealant, unless otherwise indicated.
   1. Control and Expansion Joints in Concrete Paving: Self-leveling polyurethane "traffic-grade" sealant.

C. Interior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.
   1. Wall and Ceiling Joints in Non-Wet Areas: Acrylic emulsion latex sealant.
   2. Wall and Ceiling Joints in Wet Areas: Non-sag polyurethane sealant for continuous liquid immersion.
   3. In Sound-Rated Assemblies: Acrylic emulsion latex sealant.
   4. Narrow Control Joints in Interior Concrete Slabs: Self-leveling epoxy sealant.
   5. Other Floor Joints: Self-leveling polyurethane "traffic-grade" sealant.

D. Interior Wet Areas: restrooms, kitchens, and food service areas; fixtures in wet areas include plumbing fixtures, countertops, cabinets, and other similar items.

E. Sound-Rated Assemblies: Walls and ceilings identified as "STC-rated", "sound-rated", or "acoustical".

2.03 NONSAG JOINT SEALANTS

A. Type JS-1 - Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
   1. Movement Capability: Plus and minus 50 percent, minimum.
   2. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
   3. Color: To be selected by Architect from manufacturer's standard range.
   4. Cure Type: Single-component, neutral moisture curing..
   5. Service Temperature Range: 65 to 180 degrees F.
   6. Locations:
      a. Perimeter joints between materials listed below and frames of doors, windows and louvers.
         1) Aluminum window frames to masonry
         2) Aluminum window frames to gypsum

B. Type JS-2 - Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
   1. Color: Clear.
   2. Locations:
      a. Joints between plumbing fixtures and adjoining walls, floors and counters.

C. Type JS-3 - Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single component; not expected to withstand continuous water immersion or traffic.
   1. Movement Capability: Plus and minus 50 percent, minimum.
   2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.

3. Color: To be selected by Architect from manufacturer's standard range.
4. Paintable.
5. Service Temperature Range: Minus 40 to 180 degrees F.
6. Locations:
   a. Control and expansion joints on exposed interior surfaces of exterior walls.
   b. Vertical joints on exposed surfaces of interior unit masonry and walls.
   c. Perimeter joints between interior wall surfaces and frames of interior doors and windows.
   d. Interior joints between gypsum and window solid surface sills.
   e. Interior joints between gypsum and brick.
   f. Interior joints between hollow metal frames and aluminum window frames.

D. Type JS-4 - Polyurethane Sealant for Continuous Water Immersion: ASTM C920, Grade NS, Uses M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion; suitable for traffic exposure when recessed below traffic surface.
   1. Movement Capability: Plus and minus 35 percent, minimum.

E. Type JS-5 - Non-Sag "Traffic-Grade" Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion and traffic without the necessity to recess sealant below traffic surface.
   1. Movement Capability: Plus and minus 25 percent, minimum.
   2. Hardness Range: 40 to 50, Shore A, when tested in accordance with ASTM C661.
   3. Color: To be selected by Architect from manufacturer's standard range.
   4. Service Temperature Range: Minus 40 to 180 degrees F.
   5. Locations:
      a. Isolation joints in cast-in-place concrete slabs.
      b. Control and expansion joints in tile flooring.

F. Type JS-6 - Non-Curing Butyl Sealant: Solvent-based, single component, non-sag, non-skinning, non-hardening, non-bleeding; non-vapor-permeable; intended for fully concealed applications.
   1. Locations:
      a. Under sill tracks in all exterior metal framed walls.
      b. Termination strips at roofing membrane, unless roofing manufacturer recommends alternative type of sealant.
      c. Under sill flashings at windows, lintels, and similar flashings.

2.04 SELF-LEVELING SEALANTS

A. Type JS-7 - Semi-Rigid Self-Leveling Epoxy Joint Filler: Epoxy or epoxy/polyurethane copolymer; intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.
   1. Composition: Multi-component, 100 percent solids by weight.
   2. Durometer Hardness: Minimum of 85 for Type A or 35 for Type D, after seven days when tested in accordance with ASTM D2240.
   3. Joint Width, Minimum: 1/8 inch.

2.05 ACCESSORIES

A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
   1. Closed Cell Backer Rods
      a. Type for Joints Not Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type C - Closed Cell Polyethylene.
      b. Type for Joints Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type C - Closed Cell Polyethylene.
      c. Closed Cell and Bi-Cellular: 25 to 33 percent larger in diameter than joint width.

d. Locations:
   1) All exterior joints
   2) All concrete slab joints
   3) All joints in wet areas:
      (a) Toilet rooms - all
      (b) Restrooms - all
      (c) Janitor rooms - all
      (d) Utility rooms - all

2. Open Cell Backer Rods
   a. Open Cell: 40 to 50 percent larger in diameter than joint width.
   b. Locations:
      1) Interior joints other than in areas listed above
   c. Bi-cellular backer rods are acceptable in lieu of open cell backer rods.

B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.

C. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.

D. Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.

E. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joints are ready to receive work.

B. Verify that backing materials are compatible with sealants.

C. Verify that backer rods are of the correct size.

D. Preinstallation Adhesion Testing: Install a sample for each test location indicated in the test plan.
   1. Test each sample as specified in PART 1 under QUALITY ASSURANCE article.
   2. Notify Architect of date and time that tests will be performed, at least seven days in advance.
   3. Record each test on Preinstallation Adhesion Test Log as indicated.
   4. If any sample fails, review products and installation procedures, consult manufacturer, or take whatever other measures are necessary to ensure adhesion; re-test in a different location; if unable to obtain satisfactory adhesion, report to Architect.
   5. After completion of tests, remove remaining sample material and prepare joint for new sealant installation.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in inconspicuous area to verify that it does not stain or discolor slab.

3.03 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Perform installation in accordance with ASTM C1193.

C. Perform acoustical sealant application work in accordance with ASTM C919.

D. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.
   1. Do not leave gaps between ends of sealant backings.
   2. Do not stretch, twist, puncture, or tear sealant backings.
   3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
   4. Roll backer rods into joints with adjustable backer rod insertion roller tool. Do not use sharp tools such as screwdrivers, putty knives, etc.

E. Install bond breaker backing tape where backer rod cannot be used.

F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

G. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
   1. Remove excess sealant from surfaces adjacent to joints.
   2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
   3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.

H. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

I. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

J. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

3.04 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.05 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.06 POST-OCCUPANCY

A. Post-Occupancy Inspection: Perform visual inspection of entire length of project sealant joints at a time that joints have opened to their greatest width; i.e. at low temperature in thermal cycle. Report failures immediately and repair.

END OF SECTION

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SECTION 07 95 13
EXPANSION JOINT COVER ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Expansion joint cover assemblies for floor and wall surfaces.

1.02 RELATED REQUIREMENTS

A. Section 04 20 00 - Unit Masonry: Placement of joint cover assembly frames in masonry.

B. Section 07 92 00 - Joint Sealants: Sealing expansion and control joints using gunnable and pourable sealants.

C. Section 09 21 16 - Gypsum Board Assemblies: Placement of expansion joint assemblies in gypsum board walls and ceilings.

1.03 REFERENCE STANDARDS

A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2020.

B. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.

C. ASTM B308/B308M - Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles; 2020.

D. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems; 2015 (Reapproved 2019).

E. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Installation Templates: For frames and anchors to be embedded in concrete or masonry, furnish templates to relevant installers; include installation instructions and tolerances.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide joint assembly profiles, profile dimensions, anchorage devices and available colors and finish.

C. Shop Drawings: Indicate joint and splice locations, miters, layout of the work, affected adjacent construction and anchorage locations.

D. Manufacturer's Installation Instructions: Indicate rough-in sizes and required tolerances for item placement.

E. Maintenance Materials: Furnish the following for Owner / Library's use in maintenance of project.
   1. See Section 01 60 00 for additional provisions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Expansion Joint Cover Assemblies:
   1. MM Systems Corp: www.mmsystemscorp.com/#sle.
   2. Or Approved Equal.

2.02 EXPANSION JOINT COVER ASSEMBLY APPLICATIONS

A. Interior Floor Joints Subject to Thermal Movement:
   1. Manufacturers:
      a. Basis-of-Design, MM Systems.

1) Product: Flushline System, FSSR-100

B. Interior Wall Joints Subject to Thermal Movement:
1. Manufacturers:
a. Basis-of-Design, MM Systems.
1) Product: Color Joint Silicone System, ESS-150.

C. Interior Fire-Rated Wall/Ceiling/Floor Joints Subject to Thermal Movement:
1. Manufacturers:
a. Basis-of-Design; MM Systems.
1) Product: Pyro-Flex Wall System with Expansion Joint of Color Joint Silicone System, ESS-150

D. Exterior Wall Joints Subject to Thermal Movement:
1. Manufacturers:
a. Basis of Design: MM Systems.
1) Product: Expanding Impregnated Vandal-Resistant Foam Seal, EIV-050

2.03 EXPANSION JOINT COVER ASSEMBLIES

A. Expansion Joint Cover Assemblies - General: Factory-fabricated and assembled; designed to completely fill joint openings, sealed to prevent passage of air, dust, water, smoke; suitable for traffic expected.
1. Joint Dimensions and Configurations: As indicated on drawings.
2. Joint Cover Sizes: Selected to suit joint width and configuration, based on manufacturer's published recommendations and limitations.
3. Lengths: Provide covers in full lengths required; avoid splicing wherever possible.
4. Anchors, Fasteners, and Fittings: Provided by cover manufacturer.

B. Floor Joint Covers: Coordinate with indicated floor coverings.

C. Covers in Fire Rated Assemblies: Provide cover assembly having fire rating equivalent to that of assembly into which it is installed.

2.04 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper; or ASTM B308/B308M, 6061 alloy, T6 temper.

B. Backing Paint for Aluminum Components in Contact with Cementitious Materials: Asphaltic type.

2.05 ACCESSORIES

A. Resilient Fire Barrier: For use with metal expansion joint covers and elastomeric seals without use of mechanical fasteners, with fire rating in accordance with surrounding construction performance capabilities.
1. Application: Wall.
2. Fire Resistance Rating: 1 Hour, in accordance with ASTM E1966 and UL 2079.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joint preparation and dimensions are acceptable and in accordance with manufacturer's requirements.

3.02 INSTALLATION

A. Install components and accessories in accordance with manufacturer's instructions.

B. Align work plumb and level, flush with adjacent surfaces.

C. Rigidly anchor to substrate to prevent misalignment.

3.03 PROTECTION

A. Do not permit traffic over unprotected floor joint surfaces.

END OF SECTION

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SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated hollow metal doors and frames.

B. Hollow metal frames for wood doors.

C. Thermally insulated hollow metal doors with frames.

1.02 RELATED REQUIREMENTS

A. Section 08 71 00 - Door Hardware.

B. Section 08 80 00 - Glazing: Glass for doors and borrowed lites.

C. Section 09 91 23 - Interior Painting: Field painting.

D. Section 09 96 00 - High-Performance Coatings: Field Painting

1.03 ABBREVIATIONS AND ACRONYMS

A. ANSI: American National Standards Institute.

B. HMMA: Hollow Metal Manufacturers Association.

C. NFPA: National Fire Protection Association.

D. SDI: Steel Door Institute.

E. UL: Underwriters Laboratories.

1.04 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2011.

C. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames; 2003 (R2009).

D. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2017.

E. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2011.

F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.

G. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2018.

H. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2018a.

I. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2015a.

J. ASTM C476 - Standard Specification for Grout for Masonry; 2019.

K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.

L. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames; 2016.

M. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

N. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.

O. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2011.

P. NAAMM HMMA 840 - Guide Specifications For Receipt, Storage and Installation of Hollow Metal Doors and Frames; 2007.

Q. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2014.

R. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2013.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes.

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

D. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

E. Manufacturer's Qualification Statement.

F. Installer's Qualification Statement.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of documented experience.

C. Maintain at project site copies of reference standards relating to installation of products specified.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hollow Metal Doors and Frames:
   1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com/#sle.
   2. Curries, an Assa Abloy Group company: www.assaabloydss.com/#sle.
   3. Mesker, dormakaba Group: www.meskeropeningsgroup.com/#sle.
   4. Republic Doors, an Allegion brand: www.republicdoor.com/#sle.
   5. Steelcraft, an Allegion brand: www.allegion.com/#sle.
   6. Or approved equal.

2.02 PERFORMANCE REQUIREMENTS

A. Requirements for Hollow Metal Doors and Frames:
   1. Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
   2. Accessibility: Comply with ICC A117.1 and ADA Standards.
   3. Exterior Door Top Closures: Flush end closure channel, with top and door faces aligned.
   4. Door Edge Profile: Beveled, both sides.
   5. Typical Door Face Sheets: Flush.

6. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturers standard.
7. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
8. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvannealed) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.
    a. Based on SDI Standards: Provide at least A40/ZF120 (galvannealed) when necessary, coating not required for typical interior door applications, and at least A60/ZF180 (galvannealed) for corrosive locations.

B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 HOLLOW METAL DOORS

A. Door Finish: Factory primed and field finished.

B. Type F , Exterior Doors: Thermally insulated.
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    a. Level 3 - Extra Heavy-duty.
    b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
    c. Model 2 - Seamless.
    d. Door Face Metal Thickness: 16 gage, 0.053 inch, minimum.
    e. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.
2. Door Core Material: Polyisocyanurate, 2 lbs/cu ft minimum density.
    a. Foam Plastic Insulation: Manufacturer's standard board insulation with maximum flame spread index (FSI) of 75, and maximum smoke developed index (SDI) of 450 in accordance with ASTM E84, and completely enclosed within interior of door.
    b. At exterior fire rated door, provide polystyrene core. R-value 2.6 minimum per ASTM C1363.
3. Door Thickness: 1-3/4 inches, nominal.
4. Top Closures for Outswinging Doors: Flush with top of faces and edges.
5. Weatherstripping: Refer to Section 08 71 00.
6. Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.

2.04 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.

B. Frame Finish: Factory primed and field finished.

C. Full profile/continuously welded type: Full profile welded joints continuous; grind, fill, dress and make smooth, flush and invisible.

D. Exterior Door Frames: Full profile/continuously welded type.
1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A60/ZF180 coating.
2. Frame Metal Thickness: 14 gage, 0.067 inch, minimum.
3. Weatherstripping: Separate, see Section 08 71 00.
4. See below for requirements for grouting the frames.

E. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.

F. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.

G. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inches high to fill opening without cutting masonry units.

H. Frames Wider than 48 inches: Reinforce with steel channel fitted tightly into frame head, flush with top.

I. Jamb Anchors: Provide number and spacing of anchors as follows:
   1. Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
      a. Masonry Type:
         1) Three anchors per jamb from 60 to 90 inches high.
         2) Four anchors per jamb from 90 to 120 inches high.
      b. Stud-Wall Type:
         1) Four anchors per jamb from 60 to 90 inches high.
         2) Five anchors per jamb from 90 to 96 inches high.
         3) Two anchors per head for frames more than 42 inches wide.

2.05 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

B. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15 mil, 0.015 inch dry film thickness (DFT) per coat; provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.06 ACCESSORIES

A. Glazing: As specified in Section 08 80 00, field installed.

B. Removable Stops: Formed sheet steel, mitered corners; prepared for countersink style tamper proof screws.

C. Astragals for Double Doors: Specified in Section 08 71 00.

D. Grout for Frames: Mortar grout complying with ASTM C476 with maximum slump of 4 inches as measured in accordance with ASTM C143/C143M for hand troweling in place; plaster grout and thinner pumpable grout are prohibited.

E. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.
   1. Installed on all doors except on weather/gasketed stripped frames.
      a. Exterior doors and frames.
      b. Fire rated doors and frames.
      c. See 08 71 00 Door Hardware for additional locations for gasket seals.

F. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

G. Grout for Frames: Portland cement grout with maximum 4 inch slump for hand troweling; thinner pumpable grout is prohibited.
   1. Grout frames in all CMU walls.
   2. Gypsum based grout is not acceptable.

H. Insulation: Install closed cell spray foam insulation for sound deadening in all interior door frames within gypsum walls.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 PREPARATION

A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.03 INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.

B. Coordinate frame anchor placement with wall construction.

C. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.

D. Install door hardware as specified in Section 08 71 00.

1. Comply with recommended practice for hardware placement of doors and frames in accordance with ANSI/SDI A250.6 or NAAMM HMMA 861.

E. Comply with glazing installation requirements of Section 08 80 00.

F. Coordinate installation of electrical connections to electrical hardware items.

G. Touch up damaged factory finishes.

3.04 TOLERANCES

A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.

B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.05 ADJUSTING

A. Adjust for smooth and balanced door movement.

3.06 SCHEDULE

A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION

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SECTION 08 14 16
FLUSH WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flush wood doors; flush configuration; fire-rated, non-rated, and special function.

1.02 RELATED REQUIREMENTS

A. Section 06 20 00 - Finish Carpentry: Wood door frames.

B. Section 08 11 13 - Hollow Metal Doors and Frames.

C. Section 08 14 33 - Stile and Rail Wood Doors.

D. Section 08 71 00 - Door Hardware.

E. Section 08 80 00 - Glazing.

F. Section 09 96 00 - High-Performance Coatings: Field finishing door frames.

1.03 REFERENCE STANDARDS

A. ASTM E2112 - Standard Practice for Installation of Exterior Windows, Doors and Skylights; 2019c.

B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014, with Errata (2018).

C. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1; 2017, with Errata (2019).

D. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2019.

E. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.

C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.

D. Samples: Submit two samples of door construction, 6 by 6 inches in size cut from top corner of door.

E. Manufacturer's Qualification Statement.

F. Installer's Qualification Statement.

G. Warranty, executed in Owner / Library's name.

1.05 QUALITY ASSURANCE

A. Maintain one copy of the specified door quality standard on site for review during installation and finishing.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than five years of documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than five years of documented experience.

D. Comply with AWI Standards; AWI QPC label not required.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Package, deliver and store doors in accordance with specified quality standard.

B. Accept doors on site in manufacturer's packaging, and inspect for damage.

C. Protect doors with resilient packaging sealed with heat shrunk plastic; do not store in damp or wet areas or areas where sunlight might bleach veneer; seal top and bottom edges with tinted sealer if stored more than one week, and break seal on site to permit ventilation.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Interior Doors: Provide manufacturer's warranty for the life of the installation.

C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

D. Include installation that may be required due to repair or replacement of defective doors.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wood Veneer Faced Doors:
   1. Graham-Maiman Wood Doors; https://architectural.masonite.com/graham-maiman/products/
   2. Masonite Architectural: www.architectural.masonite.com/#sle.
   3. Oregon Door: www.oregondoor.com/#sle.
   4. Oshkosh Door; oshkoshdoor.com.
   5. VT Industries, Inc: www.vtindustries.com/#sle.
   6. Or Approved Equal.

2.02 DOORS

A. Doors: See drawings for locations and additional requirements.
   1. Quality Standard: Custom Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
   2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.

B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
   1. Provide solid core doors at each location.
   2. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with UL 10C - Positive Pressure; Underwriters Laboratories Inc (UL) or Intertek/Warnock Hersey (WHI) labeled without any visible seals when door is open.
   3. Wood veneer facing with factory transparent finish as indicated on drawings.

2.03 DOOR AND PANEL CORES

A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated.

B. Fire-Rated Doors: Mineral core type, with fire resistant composite core (FD), plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.

2.04 DOOR FACINGS

A. Veneer Facing for Transparent Finish: Natural Birch, veneer grade in accordance with quality standard indicated, plain sliced (flat cut) or rotary cut, respectively, with book match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face. See 09 00 00 Finsh and Material Legend for additional information.
   1. "Pair Match" each pair of doors; "Set Match" pairs of doors within 10 feet of each other when doors are closed.

2.05 DOOR CONSTRUCTION

A. Fabricate doors in accordance with door quality standard specified.

B. Cores Constructed with stiles and rails:
   1. Provide solid blocks at lock edge for hardware reinforcement, only as required by door manufacturer.

2. Provide solid blocking for other throughbolted hardware, only as required by door manufacturer.
3. Provide mid-rail blocking in doors indicated to have exit devices, only as required by door manufacturer.
4. All blocking to be bonded to core, then entire unit abrasive planed/sanded before veneering, only as required by door manufacturer.

C. Glazed Openings: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.

D. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.

E. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.

F. Provide edge clearances in accordance with the quality standard specified.

G. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

2.06 FINISHES - WOOD VENEER DOORS

A. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
1. Transparent:
a. Stain: As selected by Architect.
b. Sheen: Satin.

B. Factory finish doors in accordance with approved sample. See Finish and Material Legend specification section 09 00 00 for color.

2.07 ACCESSORIES

A. Wood Door Frames: See Section 06 20 00.

B. Hollow Metal Door Frames: See Section 08 11 13.

C. Glazing: See Section 08 80 00.

D. Door Hardware: See Section 08 71 00.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standard.
1. Install fire-rated doors in accordance with NFPA 80 requirements.
2. Install exterior doors in accordance with ASTM E2112.

B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.

C. Use machine tools to cut or drill for hardware.

D. Coordinate installation of doors with installation of frames and hardware.

3.03 TOLERANCES

A. Comply with specified quality standard for fit and clearance tolerances.

B. Comply with specified quality standard for telegraphing, warp, and squareness.

3.04 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

B. Adjust closers for full closure.

3.05 SCHEDULE

A. See Door and Frame Schedule on drawings.

END OF SECTION

SECTION 08 14 33
STILE AND RAIL WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wood doors, stile and rail design; non-fire rated.

B. Panels of wood and glass.

1.02 RELATED REQUIREMENTS

A. Section 06 20 00 - Finish Carpentry: Wood door frames.

B. Section 08 11 13 - Hollow Metal Doors and Frames.

C. Section 08 14 16 - Flush Wood Doors: Attack-resistant door opening assemblies using stile and rail doors.

D. Section 08 71 00 - Door Hardware.

E. Section 08 80 00 - Glazing.

F. Section 09 93 00 - Staining and Transparent Finishing: Field finishing.

1.03 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014, with Errata (2018).

B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1; 2017, with Errata (2019).

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Indicate stile and rail core materials and construction; veneer species, type and characteristics.

C. Shop Drawings: Illustrate door opening criteria, elevations, sizes, types, swings, undercuts required, special beveling, special blocking for hardware, factory machining criteria, factory finishing criteria, and cutouts for glazing.

D. Samples: Submit two samples of door veneer, 8 by 10 inches in size illustrating wood grain, stain color, and sheen.

E. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

F. Manufacturer's Installation Instructions: Indicate special installation instructions.

G. Manufacturer's Qualification Statement.

H. Installer's Qualification Statement.

I. Warranty, executed in Owner / Library's name.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than three years of documented experience.

1. Accredited participant in specified certification program prior to commencement of fabrication and throughout duration of project.

B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.

C. Comply with AWI Standards; AWI QPC label not required.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Package, deliver, and store doors in accordance with quality standard specified.

B. Accept doors on site in manufacturer's packaging, and inspect for damage.

C. Protect doors with resilient packaging sealed with heat shrunk plastic; do not store in damp or wet areas or areas where sunlight might bleach veneer; seal top and bottom edges with tinted sealer if stored more than one week, and break seal on site to permit ventilation.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Interior Doors: Provide manufacturer's warranty for the life of the installation.

C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Stile and Rail Wood Doors:
   1. Koch & Company, Inc.
   2. Masonite Architectural; Aspiro Authentic Stile & Rail Doors: www.architectural.masonite.com/#sle.
   3. Oshkosh Door Company.
   4. TruStile Doors; www.trustile.com.
   5. VT Industries, Inc: www.vtindustries.com/#sle.
   6. Woodtech Trading Company; www.woodtechdoor.com.

2.02 DOORS

A. Quality Standard: Custom Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless otherwise indicated.

B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; veneer and lumber stile and rail construction; mortise and tenon joints. Transparent finish as indicated on drawings.

2.03 DOOR AND PANEL FACINGS

A. Veneer Facing for Transparent Finish: natural birch, veneer grade in accordance with quality standard indicated, rotary cut, with book match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face. See 09 00 00 Finish and Materials Legend for wood type and stain locations.
   1. Pairs: Pair match each pair; set match pairs within 10 feet of each other when doors are closed.

B. Adhesive: Type I - Waterproof.

2.04 DOOR CONSTRUCTION

A. Vertical Exposed Edge of Stiles: Of same species as veneer facing.

B. Fit door edge trim to edge of stiles after applying veneer facing.

C. Panels: Flat.

D. Molding Profile (Sticking): Square.

E. Refer to sheet A3.1 for elevations and details. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

F. Factory machine doors for finish hardware in accordance with hardware requirements and dimensions. Do not machine for surface hardware.

G. Glazed Openings: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.

H. Factory install glazing in doors in compliance with quality standards specified, using manufacturer's standard elastomeric glazing sealant.

2.05 FINISHES

A. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
   1. Transparent:
      a. Stain: As selected by Architect.
      b. Sheen: Satin.

B. Factory finish doors in accordance with approved sample. See Specification Section 09 00 00 for color.

2.06 ACCESSORIES

A. Wood Door Frames: See Section 06 20 00.

B. Hollow Metal Door Frames: See Section 08 11 13.

C. Glazing: See Section 08 80 00.

D. Panel or Glass Retention Molding: Wood of same species as door facing, flat bead stop, with butted corners; prepared for countersink style tamper proof screws.

E. Door Hardware: See Section 08 71 00.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out of tolerance for size or alignment.

3.02 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standards.

B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.

C. Machine cut for hardware.

D. Coordinate installation of doors with installation of frames and hardware.

3.03 TOLERANCES

A. Comply with specified quality standard for fit, clearance, and joinery tolerances.

B. Maximum Width Distortion (Cup): 1/8 inch measured with straight edge or taut string, edge to edge, over an imaginary 36 by 84 inch surface area.

3.04 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

B. Adjust closers for full closure.

3.05 SCHEDULE - SEE DRAWINGS

END OF SECTION

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SECTION 08 31 00
ACCESS DOORS AND PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall and ceiling mounted access units.

1.02 RELATED REQUIREMENTS

A. Section 09 91 23 - Interior Painting: Field paint finish.

B. Division 23: Mechanical components requiring access.

C. Division 22: Plumbing components requiring access.

1.03 REFERENCE STANDARDS

A. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2018a.

B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.

C. Shop Drawings: Indicate exact position of each access door and/or panel unit.

D. Manufacturer's Installation Instructions: Indicate installation requirements.

E. Manufacturer's Qualification Statement.

F. Installer's Qualification Statement.

G. Project Record Documents: Record actual locations of each access unit.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Submit stamped calculations by a registered professional engineer from within the state or territory where the project will be constructed or substantially improved, to verify the flood door’s ability to withstand the design loading.

C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

PART 2 PRODUCTS

2.01 ACCESS DOORS AND PANELS ASSEMBLIES

A. Wall-Mounted Units with Return Air Grille:
   1. Location: As indicated on drawings.
   2. Size: As indicated on Drawings.
   3. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
   4. Gypsum Board Mounting Criteria: Provide drywall bead frame with door surface flush with wall surface.

B. Wall-Mounted Units in Wet Areas:
   1. Location: As indicated on drawings.
   2. Panel Material: Steel, hot-dipped zinc, or zinc-aluminum-alloy coated.
   3. Size: As indicated on Drawings.
   4. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.

5. Gypsum Board Mounting Criteria: Provide drywall bead frame with door surface flush with wall surface.

C. Ceiling-Mounted Units:
1. Location: As indicated on drawings.
2. Panel Material: Steel.
3. Size - Lay-In Grid Ceilings: To match module of ceiling grid.
4. Size - Other Ceilings: As indicated on Drawings.
5. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.

2.02 WALL AND CEILING MOUNTED ACCESS UNITS

A. Wall and Ceiling Mounted Units: Factory fabricated door and frame, fully assembled units with corner joints welded, filled and ground flush; square and without rack or warp; coordinate requirements with type of installation assembly being used for each unit.
1. Door Style: Single thickness with rolled or turned in edges.
2. Steel Finish: Primed.
3. Aluminum Finish: Natural brushed.
4. Primed and Factory Finish: Polyester powder coat; color to match adjacent surfaces.
5. Hardware:
a. Hinges for Non-Fire-Rated Units: Concealed, constant force closure spring type.
b. Latch/Lock: Tamperproof tool-operated cam latch.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that rough openings are correctly sized and located.

B. Begin installation only after substrates have been properly prepared, and if the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to proceeding with this work.

B. Prepare surfaces using methods recommended by manufacturer for applicable substrates in accordance with project conditions.

3.03 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Install frames plumb and level in openings, and secure units rigidly in place.

C. Position units to provide convenient access to concealed equipment when necessary.

END OF SECTION

SECTION 08 33 23
OVERHEAD COILING DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire-rated coiling doors.

1.02 RELATED REQUIREMENTS

A. Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

B. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

C. ITS (DIR) - Directory of Listed Products; Current Edition.

D. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2019.

E. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives; 2019.

F. UL (DIR) - Online Certifications Directory; Current Edition.

G. UL 1784 - Standard for Air Leakage Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide general construction and component connections and details.

C. Shop Drawings: Indicate pertinent dimensioning, anchorage methods, hardware locations, and installation details.

D. Manufacturer's Installation Instructions: Indicate installation sequence and procedures, adjustment and alignment procedures.

E. Manufacturer's qualification statement.

F. Installer's qualification statement.

G. Maintenance Data: Indicate lubrication requirements and frequency and periodic adjustments required.

H. Specimen warranty.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years documented experience.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide 2-year manufacturer warranty for roller shaft counterbalance assembly. Complete forms in Owner / Library's name and register with manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Overhead Coiling Fire Doors:
   1. Alpine Overhead Doors, Inc; Fire-Tite Series: www.alpinedoors.com/#sle.
   2. Overhead Door Corporation; FireKing Model 630 Fire Doors: www.overheaddoor.com/#sle.

3. Raynor Garage Doors; FireCoil, Model Flat Slat: www.raynor.com/#sle.
4. Wayne-Dalton, a Division of Overhead Door Corporation; FireStar 700 Rolling Steel Fire Door: www.wayne-dalton.com/#sle.
5. Or Approved Equal. Manufacturers listed above are acceptable, product must meet specification requirements listed in sections below.

2.02 COILING DOORS

A. Fire-Rated Coiling Doors: Steel slat curtain; comply with NFPA 80.
   1. 1 hour fire rating.
      a. Provide smoke and draft control door assemblies tested in accordance with UL 1784.
   2. Provide products listed and labeled by ITS (DIR) or UL (DIR) as suitable for purpose specified and indicated on drawings.
   3. Oversized Openings: Provide certificate of compliance from authorities having jurisdiction indicating approval of fire rated units and operating hardware assembly.
   4. Single Thickness Slats: Manufacturer's standard.
   5. Finish: Factory painted, color as selected.
   6. Guides, Angles: Stainless steel.
   7. Hood Enclosure: Manufacturer's standard; primed steel.
   8. Coiling Door Release Mechanism: Fire alarm system activated with automatically governed closing speed.
   9. Manual push up operation.

2.03 MATERIALS

A. Metal Curtain Construction: Interlocking slats.
   1. Slat Ends: Each slat fitted with end locks to act as wearing surface in guides and to prevent lateral movement.
   2. Curtain Bottom for Slat Curtains: Fitted with angles to provide reinforcement and positive contact in closed position.
   3. Weatherstripping for Exterior Doors: Moisture and rot proof, resilient type, located at jamb edges, bottom of curtain, and where curtain enters hood enclosure of exterior doors.
   4. Smoke Seals: Provide brush or gasket type weatherstripping seals to prevent passage of smoke and hot gases in compliance with UL 1784 testing requirements.

B. Guide Construction: Continuous, of profile to retain door in place with snap-on trim, mounting brackets of same metal.

C. Guides - Angle: ASTM A36/A36M metal angles, size as indicated.
   1. Stainless Steel: ASTM A 666, Type 304, rollable temper.

D. Hood Enclosure and Trim: Internally reinforced to maintain rigidity and shape.

E. Roller Shaft Counterbalance: Steel pipe and helical steel spring system, capable of producing torque sufficient to ensure smooth operation of curtain from any position and capable of holding position at mid-travel; with adjustable spring tension; requiring 25 lb nominal force to operate.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that adjacent construction is suitable for door installation.

B. Verify that electrical services have been installed and are accessible.

C. Verify that door opening is plumb, header is level, and dimensions are correct.

D. Notify Architect of any unacceptable conditions or varying dimensions.

E. Commencement of installation indicates acceptance of substrate and door opening conditions.

3.02 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Install fire-rated doors in accordance with NFPA 80.

C. Install smoke door assemblies in accordance with NFPA 105.

D. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.

E. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.

F. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

G. Complete wiring from fire alarm system.

H. Install enclosure and perimeter trim.

3.03 TOLERANCES

A. Maintain dimensional tolerances and alignment with adjacent work.

B. Maximum Variation From Plumb: 1/16 inch.

C. Maximum Variation From Level: 1/16 inch.

D. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch per 10 feet straight edge.

3.04 ADJUSTING

A. Adjust operating assemblies for smooth and noiseless operation.

3.05 CLEANING

A. Clean installed components.

B. Remove labels and visible markings.

END OF SECTION

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SECTION 08 33 26
SLIDING COILING GRILLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. **Side-coiling** metal grilles and operating hardware; manually operated.

B. **Overhead-Coiling** metal grilles and operating hardware; manually operated.

C. Associated door closure.

1.02 RELATED REQUIREMENTS

A. Section 08 71 00 - Door Hardware: Cylinder cores and keys.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide general construction component connections and details.

C. Shop Drawings: Indicate pertinent dimensioning, anchorage methods, hardware locations, and installation details.

D. Manufacturer's Installation Instructions: Indicate installation sequences and procedures, adjustment and alignment procedures.

E. Manufacturer's Qualification Statement.

F. Maintenance Data: Indicate lubrication requirements and frequency and periodic adjustments required.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Side Coiling Grilles:
   1. Basis of Design: MobilFlex; 'System S-12' or Equal.
   2. Finish: To be selected from manufacturer's full range.

B. Overhead Rolling Grilles:
   1. Basis of Design: MobilFlex; 'Roll-Flex' or Equal.
   2. Finish: To be selected from manufacturer's full range.

2.02 GRILLES AND COMPONENTS

A. System S-12 Curtain: Constructed of 6 inch wide modules linked together by a continuous aluminum hinge. These hinges hold steel perforated panels with 3/16 inch diameter holes providing a 51% visibility and ventilation through the panels. The top and bottom of each section is fitted with an aluminum panel 4 inches high. This panel consists of an aluminum extrusion 1/16 inch thick and composed of modules with a 15 degree angle between them to facilitate the operation of the closure.

B. Roll-Flex Curtain: Constructed of 3” on center extruded aluminum sections. Each section framed by continuous double “C” hinge hold 2 1⁄2” high x 0,050” aluminum slats leaving 15 3⁄4" X 2 1⁄2" open spaces in a brick pattern.

C. Horizontal Track: Curtain shall be hung from an overhead track 1-5/16” wide by 1-9/16” high. Track shall be tempered aluminum alloy 6063-T5.

1. Curves where required shall be 10” radius standard.

D. Vertical Guides: Curtain guides are to be of extruded aluminum 1 5/8” wide x 2 3⁄4” deep with nylon brush seal to allow smooth operation. Top stoppers to be installed on each guide to stop upward movement of curtain at secured position.

E. Hood Enclosure and Trim: Sheet metal; completely covering operating mechanisms; internally reinforced to maintain rigidity and shape. **Recessed in Ceiling at coiling door location.**
   1. Material: Same metal as grille.

F. Stacking: Stacking shall not exceed a depth of 1.15” per foot of closure width plus 3” for each post (lead, end or intermediate).

G. Locking:
   1. Lead post shall be equipped with a hook bolt lock with High security or master keyed lock cylinders (customer supplied and factory fitted) each side.
   2. Lead post shall engage a full height wall jamb.
   3. Trailing post shall be self-locking at the top and bottom inside the storage pocket.
   4. Free floating intermediate posts shall be located at all curves and at recommended intervals of 10 feet or 5 feet for counter top units. Intermediate posts shall be equipped with selfadjusting spring loaded drop bolts activated from the inside only. Drop bolts shall engage dustproof stainless steel receptacles.

H. Coiling Roller Shaft Counterbalance: Oil tempered, helical torsion spring(s) pre-lubricated and secured around a continuous, solid, cold rolled steel inner shaft will act as counter balance within barrel. Shaft will bear on self aligning, permanently lubricated ball bearing assemblies. Counterbalance assembly to be designed for a minimum life of 20,000 cycles. Spring to be site tensioned by attached, accessible charging wheel.

I. Coiling Barrel: Minimum 6 5/8” diameter X 0.156 wall steel pipe barrel will be designed to carry curtain load with a maximum allowable deflection of 0.03” per foot of closure width. Barrel to house a torsion spring counter-balance assembly to counter-balance the curtain.

J. Manual Operation: Standard closure to be manually operated push up, pull down with removable retrieval rod. The effort to raise or lower the closure shall not exceed 15 pounds force.

2.03 DOOR CLOSURE

A. Manufacturer to provide door closure to close stacking location. Door to be of a size to allow free passage of sliding grille with minimal head opening. Door to be as follows:
   1. A36 HR steel.
   2. USS 12 gauge.
   3. Primer finish ONLY. (Final paint to match wall color.)
   4. Piano hinge full height.
   5. Mortise cylinder to be provided by door hardware supplier to match keying system.

2.04 MATERIALS

A. Aluminum: ASTM B221 (ASTM B221M).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that opening sizes, tolerances and conditions are acceptable.

3.02 INSTALLATION

A. Install grille unit assembly in accordance with manufacturer's instructions.

B. Use anchorage devices to securely fasten assembly to ceiling construction and building framing without distortion or stress.

C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.

D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

E. Install enclosure and perimeter trim.

3.03 TOLERANCES

A. Maintain dimensional tolerances and alignment with adjacent work.

B. Maximum Variation From Plumb: 1/16 inch.

C. Maximum Variation From Level: 1/16 inch.

D. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch per 10 ft straight edge.

3.04 ADJUSTING

A. Adjust grille, hardware and operating assemblies for smooth and noiseless operation.

3.05 CLEANING

A. Clean grille and components.

B. Remove labels and visible markings.

END OF SECTION

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SECTION 08 41 26
ALL-GLASS ENTRANCES AND STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. All-glass storefronts.

B. Swinging doors.

1.02 RELATED REQUIREMENTS

A. Section 05 40 00 - Cold-Formed Metal Framing: Supplementary supports.

B. Section 08 71 00 - Door Hardware.

C. Section 09 21 16 - Gypsum Board Assemblies.

1.03 REFERENCE STANDARDS

A. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

B. ASTM C1036 - Standard Specification for Flat Glass; 2016.

C. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene at project site seven calendar days prior to scheduled beginning of construction activities of this section to review section requirements.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's descriptive literature for each component in all-glass entrance assembly.

C. Shop Drawings: Drawings showing layout, dimensions, identification of components, and interface with adjacent construction.
   1. Include field measurements of openings.
   2. Include elevations showing:
      a. Appearance of all-glass entrance layouts.
      b. Locations and identification of manufacturer-supplied door hardware and fittings.
      c. Locations and sizes of cut-outs and drilled holes for other door hardware.
   3. Include details of:
      a. Requirements for support and bracing at openings.
      b. Installation details.
      c. Appearance of manufacturer-supplied door hardware and fittings.
   4. Schedule: Listing of each type component in all-glass entrance assemblies, cross-referenced to shop drawing plans, elevations, and details.

D. Selection Samples: Two sets, representing manufacturer's full range of available metal materials and finishes.

E. Certificates: Contractor's certification that installer of entrance assemblies meets specified qualifications.

F. Installer's Qualification Statement.

G. Operation and Maintenance Data: For manufacturer-supplied operating hardware.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Minimum three years of experience installing entrance assemblies similar to those specified in this section.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until installation.

PART 2 PRODUCTS

2.01 ALL-GLASS ENTRANCES AND STOREFRONTS

A. Manufacturers:
   1. Avanti Systems USA, Inc: www.avantisystemsusa.com/#sle.
   2. DORMA USA, Inc; Uniquin: www.dorma.com/#sle.
   3. Trulite Glass & Aluminum Solutions, LLC; Envision All Glass Systems with P Style Door: www.trulite.com/#sle
   4. Blumcraft of Pittsburgh; CR Laurence Co, Inc. 1301 Series Entrance and Sidelite System.
   5. Or Approved Equal.

2.02 MATERIALS

A. Glass: Flat glass meeting requirements of ASTM C1036, Type I - Transparent Flat Glass, Quality Q3, and Kind FT, fully tempered, in accordance with ASTM C1048, and as follows:
   1. Thickness: 3/8 inch.
   2. Color: Class 1, Clear.
   3. Temper glass materials horizontally; visible tong marks or tong mark distortions are not permitted.

B. Sealant: One-part silicone sealant, comply with ASTM C920, clear.

C. **Provide silicone spacers vertically between glass panels for acoustics.**

2.03 ACCESSORIES

A. Exposed Fittings and Hardware: Stainless steel, brushed finish.

B. Fixed Glazed Panel Fittings: Sufficient to structurally support glazing and doors under specified loads; including but not limited to cover caps for door hardware, glazing mullions, clamp fittings, and panel corner patches.

C. Sidelight Fittings:
   1. Rail Cross-section: 1-3/4 inches wide; top rail 3-1/2 inches high, bottom rail 4 inches high.
   2. Provide top and bottom installation track for sidelite installation.

D. Swinging Door Fittings with Pivots: Patch fitting at top pivot corner of door; continuous rail with pivot at bottom of door.
   1. Rail Cross-Section: 1-3/4 inches wide by 3-1/2 inches high.
   2. Rail Profile: Tapered.

E. **Door Hardware: Specified in Section 08 71 00.**

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that openings are acceptable.

B. Do not begin installation until substrates and openings have been properly prepared.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean substrates thoroughly prior to installation.

B. Prepare substrates using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Installation of metal framing for openings as specified in Section 09 21 16.

B. Install in accordance with manufacturer's installation instructions.

C. Tolerances:
   1. Horizontal Components and Sight Lines: Not more than 1/8 inch in 10 feet variation from level, non-cumulative.
   2. Vertical Components and Sight Lines: Not more than 1/8 inch in 10 feet variation from plumb, non-cumulative.
   3. Variation from Plane or Indicated Location: Not more than 1/16 inch.

D. Installation of door hardware not supplied by entrance/storefront manufacturer as specified in Section 08 71 00.

3.04 ADJUSTING

A. Adjust doors to operate correctly, without binding to frame, sill, or adjacent doors.

B. Adjust door hardware for smooth operation.

3.05 CLEANING

A. Clean installed work to like-new condition.

3.06 PROTECTION

A. Protect installed products until Date of Substantial Completion.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

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SECTION 08 42 29
AUTOMATIC ENTRANCES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Packaged power-operated door assemblies of following types:
   1. Sliding type.

B. Controllers, actuators and safety devices.

C. Maintenance.

1.02 RELATED REQUIREMENTS

A. Section 28 10 00 - Access Control: Connection to access control system; access control devices used as actuators.

1.03 DEFINITIONS

A. AAADM: American Association of Automatic Door Manufacturers.

1.04 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).

C. BHMA A156.10 - American National Standard for Power Operated Pedestrian Doors; 2017.

D. ITS (DIR) - Directory of Listed Products; Current Edition.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL (DIR) - Online Certifications Directory; Current Edition.

H. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:
   1. Indicate layout and dimensions; head, jamb, and sill conditions; elevations; components, anchorage, recesses, materials, and finishes, electrical characteristics and connection requirements.

C. Product Data: Provide data on system components, sizes, features, and finishes.

D. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and manufacturer's hardware and component templates.

E. Manufacturer's Qualification Statement.

F. Installer's Qualification Statement.

G. Project Record Documents: Record actual locations of concealed equipment, services, and conduit.

H. Maintenance Data: Include manufacturer's parts list and maintenance instructions for each type of hardware and operating component.

I. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner / Library's name and registered with manufacturer.

J. Maintenance Materials: Furnish the following for Owner / Library's use in maintenance of project.
   1. Wrenches and other tools required for maintenance of equipment.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience, and a member of AAADM.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience and approved by manufacturer.
   1. Certified by AAADM.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide two year manufacturer warranty.

D. Provide ten year finish warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Sliding Automatic Entrance Door Assemblies:
   1. ASSA ABLOY Entrance Solutions; Besam SL500: www.besam-usa.com/#sle.
   2. DORMA USA, Inc; ESA200: www.dorma.com/#sle.
   3. Horton Automatics: www.hortondoors.com/#sle.
   4. NABCO Entrances Inc; GT 1175 Whisper Slider: www.nabcoentrances.com/#sle.
   5. record-usa; 5100 Series: www.recorddoors.com/#sle.
   6. Stanley Access Technologies; DuraFit Telescoping Automatic Doors: www.stanleyaccess.com/#sle.
   7. Or Approved Equal.

B. All-Glass Sliding Automatic Entrance Door Assemblies:
   1. ASSA ABLOY Entrance Solutions; Besam SL500 CGL All Glass Slider: www.besam-usa.com/#sle.
   2. Horton Automatics; All Glass Series 2500: www.hortondoors.com/#sle.
   3. NABCO Entrances Inc; GT 1175 All Glass Whisper Slider: www.nabcoentrances.com/#sle.
   4. record-usa; 5200 Series All Glass: www.recorddoors.com/#sle.
   5. Stanley Access Technologies; Dura-Glide All Glass 2000: www.stanleyaccess.com/#sle.
   6. Or Approved Equal.

2.02 POWER OPERATED DOORS

A. Power Operated Doors: Provide products that comply with NFPA 101 and requirements of authorities having jurisdiction; provide equipment selected for actual door weight and for light pedestrian traffic, unless otherwise indicated.
   1. Sliding and Folding Door Operators: In the event of power failure, provide for manual open, close, and break-away operation of door leaves.
   2. Packaged Door Assemblies: Provide components by single manufacturer, factory-assembled, including doors, frames, operators, actuators, and safeties.
      a. Finish exposed equipment components to match door and frame finish.
   3. Air Leakage: Maximum of 1.0 cu ft/min/sq ft of wall area, when tested in accordance with ASTM E283 at 1.57 lbs/sq ft pressure differential across assembly.
   4. Exterior and Vestibule Doors: Provide equipment suitable for operating temperature range of minus 30 to plus 130 degrees F ambient.

B. Sliding and Folding Doors with Full Power Operators: Comply with BHMA A156.10; safeties required; provide break-away operation unless otherwise indicated; in the event of break-away

operation, interrupt power operation.
1. Comply with UL 325; acceptable evidence of compliance includes UL (DIR) or ITS (DIR) listing or test report by testing agency acceptable to authorities having jurisdiction.
2. Force Required to Swing Break-Away Panel: 50 pound-force, maximum, measured at 1 inch from the latch edge of the door at any point in the closing cycle.

C. Operators:
1. Electric Operators: 1/8 hp minimum, self-contained, gear driven.

2.03 AUTOMATIC ENTRANCE DOOR ASSEMBLIES

A. Comply with ADA Standards for egress requirements.

B. Framing and Transom Members: Provide manufacturer's standard extruded aluminum framing, reinforced as required to support imposed loads.
1. Nominal Sizes:
   a. Telescoping Sliding Doors: 1-3/4 inch wide by 6 inch deep.
2. Concealed Fastening: Provide concealed fastening pocket in framing, with continuous flush insert cover extending full length of each framing member.
3. Transoms: Provide flush glazed transom with framing that is integral with automatic entrance framing system.

C. Door and Sidelight Construction: Heavy duty interlocked extruded aluminum tubular stile and rail sections, through-rod bolted construction with steel corner support at hinge stile of carrier-suspended swinging panels or mechanically fastened corners with welded reinforcing brackets to reduce sag in sliding or breakout mode.
1. Door Thickness: 1-3/4 inch, nominal.
2. Stile Design:
   a. Narrow stile, 2 inch, nominal width.
3. Top Rail Height: 4 inch, nominal.
4. Bottom Rail Height: 12 inch, nominal.
5. Glazing Stops: Manufacturer's standard snap-on extruded aluminum square stops with preformed resilient glazing gaskets.
6. Glazing Stop Width: Manufacturers standard.
7. Glazing Thickness: 1 inch.

D. Sliding Automatic Door: Bi-parting double leaf track-mounted, electric operation, extruded aluminum glazed door, with frame, and operator concealed overhead.
1. Operation: Power open, power boost operation.
2. Exterior-Side Actuator/Safety: Motion sensor.
3. Interior-Side Actuator/Safety: Motion sensor.
4. Hold Open: Toggle switch at inside head of doors; this is not a fire-rated door.
5. Door and Frame Finish: Anodized, dark bronze.
6. Threshold: Standard, surface-mounted saddle threshold.
7. Location: Entrances and Vestibules, as scheduled.

E. All-Glass Sliding Automatic Door, Type 138.1: Bi-parting double leaf track-mounted, electric operation, all-glass door with extruded aluminum top and bottom rails and operator concealed overhead.
1. Operation: Power open, power boost operation.
2. Exterior-Side Actuator/Safety: Motion sensor.
3. Interior-Side Actuator/Safety: Motion sensor.
4. Hold Open: Toggle switch at inside head of doors; this is not a fire-rated door.
5. Rail and Frame Finish: Same as adjacent framing system.

2.04 CONTROLLERS, ACTUATORS, AND SAFETIES

A. Controller: Provide microprocessor operated controller for each door.

B. Motion Sensor Actuator/Safety: Passive infrared; distance of control sensitivity adjustable.

C. Photo-Electric Actuator/Safety: Horizontal single ray device, with aluminum housing for light source and relay units.

2.05 ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Electrical Characteristics: As coordiantated with electrical drawings.

B. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.

C. Disconnect Switch: Factory mount disconnect switch in control panel.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that electric power is available and is of the correct characteristics.

3.02 INSTALLATION

A. Install equipment in accordance with manufacturer's instructions.

B. Provide for thermal expansion and contraction of door and frame units and live and dead loads that may be transmitted to operating equipment.

C. Provide for dimensional distortion of components during operation.

3.03 ADJUSTING

A. Adjust door equipment for correct function and smooth operation.

3.04 CLEANING

A. Remove temporary protection, clean exposed surfaces.

3.05 CLOSEOUT ACTIVITIES

A. Demonstrate operation, operating components, adjustment features, and lubrication requirements.

3.06 MAINTENANCE

A. See Section 01 70 00 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Provide service and maintenance of operating equipment for one year from Date of Substantial Completion, at no extra charge to Owner / Library.

END OF SECTION

SECTION 08 43 13
ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum-framed storefront, with vision glass.

B. Infill panels of glass.

C. Aluminum doors and frames.

D. Weatherstripping.

1.02 RELATED REQUIREMENTS

A. Section 08 44 13 - Glazed Aluminum Curtain Walls.

B. Section 08 71 00 - Door Hardware: Hardware items other than specified in this section.

C. Section 08 80 00 - Glazing: Glass and glazing accessories.

1.03 REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; 2015.

B. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.

C. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).

D. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.

E. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

F. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2020.

G. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.

H. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).

I. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.

J. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2016).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with installation of other components that comprise the exterior enclosure.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, and internal drainage details.

C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.

D. Samples: Submit two samples 4 x 4 inches in size illustrating finished aluminum surface, glass, infill panels, glazing materials.

E. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.

F. Design Data: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations.

G. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.

H. Manufacturer's Qualification Statement.

I. Installer's Qualification Statement.

J. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner / Library's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.08 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

1.09 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a two year period after Date of Substantial Completion.

C. Provide ten year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

D. Provide ten year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: Tubelite; TU24650 Series Storefront.

2.02 OTHER ACCEPTABLE - ALUMINUM-FRAMED STOREFRONTS MANUFACTURERS:

A. Kawneer North America: www.kawneer.com/#sle.

B. Manko Window Systems, Inc: www.mankowindows.com/#sle.

C. Oldcastle BuildingEnvelope: www.oldcastlebe.com/#sle.

D. Pittco Architectural Metals Inc: www.pittcometals.com/#sle.

E. Trulite Glass & Aluminum Solutions, LLC: www.trulite.com/#sle.

F. YKK AP America Inc: www.ykkap.com/#sle

G. Or approved equal.

2.03 ALUMINUM-FRAMED STOREFRONT

A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
   1. Glazing Rabbet: For 1 inch insulating glazing.

2. Glazing Rabbet: For 1/4 inch monolithic glazing.
3. Glazing Position: Front-set.
4. Vertical Mullion Dimensions:
   a. Exterior Storefront:2 inches by 6 1/2 inches
   b. Interior Storefront: 2 inches wide by 4-1/2 inches deep.
5. Finish: Class I color anodized. Medium Bronze.
   a. Factory finish all surfaces that will be exposed in completed assemblies.
6. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
7. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
8. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
9. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
10. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
11. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
12. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with inside pane of glazing and inner sheet of infill panel and heel bead of glazing compound.

B. Performance Requirements:
1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
   a. Design Wind Loads: Comply with requirements of ASCE 7.
   b. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
2. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 8 psf.
3. Air Leakage Laboratory Test: Maximum of 0.06 cu ft/min sq ft of wall area, when tested in accordance with ASTM E283 at 6.27 psf pressure differential across assembly.
4. Condensation Resistance Factor of Framing: 50, minimum, measured in accordance with AAMA 1503.
5. Overall U-value Including Glazing: 0.36 Btu/(hr sq ft deg F), maximum.

2.04 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, drainage holes and internal weep drainage system.
1. Framing members for interior applications need not be thermally broken.
2. Glazing Stops: Flush.

B. Glazing: As specified in Section 08 80 00.

C. Swing Doors: Glazed aluminum.
1. Thickness: 1-3/4 inches.
2. Top Rail: 5 inches wide.
3. Vertical Stiles: 5 inches wide.
4. Bottom Rail: 10 inches wide.
5. Glazing Stops: Square.

6. Finish: Same as storefront.

2.05 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Fasteners: Stainless steel.

C. Exposed Flashings: Aluminum sheet, 20 gage, 0.032 inch minimum thickness; finish to match framing members.

D. Concealed Flashings: Galvanized steel, 26 gage, 0.0179 inch minimum base metal thickness.

E. Sealant for Setting Thresholds: Non-curing butyl type.

F. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

G. Glazing Accessories: As specified in Section 08 80 00.

2.06 FINISHES

A. Class I Color Anodized Finish: AAMA 611 AA-M12C22A42 Integrally colored anodic coating not less than 0.7 mils thick.

B. Color: As selected by Architect from manufacturer's full range. Interior storefront colors may be different than exterior storefront.

2.07 HARDWARE

A. For each door, include weatherstripping and sill sweep strip.

B. Other Door Hardware: As specified in Section 08 71 00.

C. Weatherstripping: Wool pile, continuous and replaceable; provide on all doors.

D. Sill Sweep Strips: Resilient seal type, of neoprene; provide on all doors.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

3.02 INSTALLATION

A. Install wall system in accordance with manufacturer's instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.

H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

I. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inch per 3 feet non-cumulative or 0.06 inch per 10 feet, whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

3.04 ADJUSTING

A. Adjust operating hardware and sash for smooth operation.

3.05 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, and take care to remove dirt from corners and to wipe surfaces clean.

C. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

3.06 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

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SECTION 08 45 00
TRANSLUCENT WALL ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Self supporting aluminum framed vertical glazing system.

B. Sandwich panels of translucent skins separated with an aluminum grid.

1.02 RELATED REQUIREMENTS

A. Section 07 25 00 - Weather Barriers: Sealing perimeter frame to weather barrier installed on adjacent construction.

B. Section 07 92 00 - Joint Sealants: Sealing joints between perimeter frame and adjacent construction.

1.03 REFERENCE STANDARDS

A. AAMA CW-DG-1 - Aluminum Curtain Wall Design Guide Manual; 1996, with Editorial Revision (2005).

B. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.

C. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2017a.

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.

F. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2020.

G. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.

H. ASTM D2244 - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates; 2016.

I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.

J. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.

K. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.

L. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2016).

M. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with installation of firestopping, air barrier, and vapor retarder.

B. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, panel configuration, and internal drainage details.

C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, weep drainage network, expansion and contraction joint locations and details, and required field welding.

D. Samples: One panel, 6 by 6 inches in size, illustrating prefinished aluminum surface, specified panel with skins, glazing materials illustrating edge and corner.

E. Design Data: Show structural and physical characteristics, engineering calculations, and dimensional limitations.

F. Test Reports: Substantiating engineering data, test results of previous tests by independent laboratory demonstrating compliance with performance requirements.

G. Installation Data: Special installation requirements.

H. Designer's Qualification Statement.

I. Manufacturer's Qualification Statement.

J. Installer's Qualification Statement.

1.06 QUALITY ASSURANCE

A. Perform work in accordance with AAMA CW-DG-1.

B. Designer Qualifications: Design structural support framing components under direct supervision of Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

D. Installer Qualifications: Company specializing in performing the work of this section with at least three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect prefinished aluminum surfaces with wrapping; do not use adhesive papers or sprayed coatings that bond when exposed to sunlight or weather.
   1. Puncture wrappings at ends for ventilation.

1.08 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F.

B. Maintain this minimum temperature during and after installation of sealants.

1.09 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Correct defective work within a one year period after Date of Substantial Completion.

C. Provide ten year manufacturer warranty against failure of insulated translucent sandwich panels, including excessive deflection, defects in accessories, and other components of this work after Date of Substantial Completion.

D. Provide ten year manufacturer warranty against excessive degradation of exterior finish; includes provision for replacement of units with excessive cracking, peeling, and adhesion failure after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Sandwich Panel - Translucent Wall Assemblies:
   1. Kalwall Corporation: www.kalwall.com/#sle.
   2. Major Industries, Inc; Guardian 275: www.majorskylights.com/#sle.

2.02 PERFORMANCE REQUIREMENTS

A. System Design: Design and size components to withstand dead loads and live loads caused by snow, hail, and positive and negative wind loads acting on plane of panel without damage or permanent set.
   1. Design Loads: Calculate in accordance with applicable code.
   2. Measure performance in accordance with ASTM E330/E330M, using test load of 1.5 times the design wind pressure and 10 second duration of maximum load.

B. Deflection: Limit panel mullion deflection to L/60 with full recovery of glazing materials.

C. System Assembly: Accommodate without damage to system, components or deterioration of seals; movement within system; movement between system and perimeter framing components; dynamic loading and release of loads; deflection of structural support framing, tolerance of supporting components.

D. Solar Heat Gain Coefficient (SHGC): 0.09, nominal.

E. Color Stability: Color of exterior face sheet to not change color more than three CIE Units DELTA E in accordance with ASTM D2244 after 5 years outdoors in South Florida weathering facing south; color stability is not affected by abrasion or scratching.

F. Thermal Resistance of Panel System (Excluding Vision Areas): U-Value of 0.15.

G. Air Leakage: Limit air leakage through assembly to 0.06 cu ft/min sq ft of sloped glazed area, measured at pressure differential across assembly of 1.57 psf in accordance with ASTM E283/E283M.

H. Static Pressure Vapor Seal: Provide vapor seal that maintains interior static pressure of at least 1 inch water column (WC) at 72 degrees F and 40 percent relative humidity.

I. Condensation Resistance Factor (CRF): Minimum of 85 when measured in accordance with AAMA 1503.

J. Water Leakage: None, when measured in accordance with ASTM E331 at a test pressure difference of 2.86 psf.

K. Expansion/Contraction: System to provide for expansion and contraction within system components caused by a cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components.

L. System Internal Drainage: Drain water entering joints, condensation occurring in framing system, or migrating moisture occurring within system, to the exterior by a weep drainage network.

M. Fabricate to prevent vibration harmonics, thermal movement transmitted to other building elements, and loosening, weakening, or fracturing of attachments or components of system.

2.03 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Sheet Aluminum: ASTM B209 (ASTM B209M).

C. Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

D. Steel Sections: ASTM A36/A36M; shaped to suit mullion sections.

E. Fasteners: Stainless steel.

2.04 COMPONENTS

A. Translucent Wall System: Structurally reinforced translucent panels, with self-supporting framing, shop fabricated, factory prefinished, battens, cap strips, related flashings, anchorage and attachment devices.

B. Panel Assemblies: Bonded to both sides of structural extruded aluminum grid with manufacturers standard pattern; exposed surfaces of exterior sheet chemically and permanently treated to protect against surface erosion and extreme weather conditions;

polyvinyl fluoride film coated.
1. Panel Thickness: 4 inches.

C. Face Sheets: Fiberglass reinforced polymer (FRP).
1. Type: Flat panel.
2. Exterior Face Sheet: Crystal, and smooth.
a. Color: Manufacturer's standard.
b. Thickness: 0.07 inch, minimum.
3. Interior Face Sheet: White, and smooth.
a. Color: Manufacturer's standard.
b. Thickness: 0.45 inch, minimum.
c. Provide exposed surface of interior face sheets with Flame Spread Index (FSI) of less than 25 and Smoke Developed Index (SDI) of less than 450 in accordance with ASTM E84 and UL 723.

D. Support Framing Members: Mechanically interlocked, extruded-aluminum I-beams, with a minimum flange width of 7/16 inch..

E. Battens, Cover Strips, Cover Plates, and Integral Flashings: Extruded aluminum, to suit location and application; sized to rigidly retain panels in place.

F. Weather Seals: To suit application and in accordance with Section 07 25 00; non-bleeding; non-staining.

G. Sealant for Within Translucent Assembly: As required by manufacturer; see Section 07 92 00.

H. Sill Flashing Sealant: Elastomeric, silicone or polyurethane, and compatible with flashing material; see Section 07 92 00.

2.05 FABRICATION

A. Fabricate system components with minimum clearances and shim spacing around perimeter of assembly, and ensure proper installation and dynamic movement of perimeter seals.

B. Accurately fit and secure joints and corners. Make joints flush and hairline.

C. Prepare components to receive fabricated anchor devices.

D. Locate fasteners and attachments to ensure concealment from view.

E. Reinforce framing members for external imposed loads.

2.06 FINISHES

A. High Performance Organic Coatings: AAMA 2604; multiple coats, thermally cured fluoropolymer system.

B. Color: To be selected by Architect from manufacturer's standard range.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify wall openings and adjoining air barrier and vapor retarder materials are ready to receive work of this section; see Section 07 25 00 for additional information.

3.02 SURFACE PREPARATION

A. Where aluminum contacts dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.

B. Where aluminum contacts concrete, masonry or pressure treated wood, protect against corrosion by painting contact surfaces with bituminous paint or method recommended by manufacturer.

3.03 INSTALLATION

A. Install translucent panel system with cells vertical in accordance with manufacturer instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances and align with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings.

3.04 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inch per 3 feet non-cumulative or 1/2 inch per 100 feet, whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

C. Sealant Space Between Panel System Members and Adjacent Construction: Maximum of 3/4 inch and minimum of 1/4 inch.

3.05 CLEANING

A. Remove protective material from prefinished aluminum surfaces.

B. Wash down interior and exterior surfaces with solution of mild detergent in warm water, applied with soft, clean wiping cloths; remove dirt from corners and wipe surfaces clean.

3.06 PROTECTION

A. Protect finished work from damage until Date of Substantial Completion.

END OF SECTION

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SECTION 08 51 13
ALUMINUM WINDOWS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Extruded aluminum windows with fixed sash.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Rough opening framing.

B. Section 07 25 00 - Weather Barriers: Sealing frame to weather barrier installed on adjacent construction.

C. Section 07 92 00 - Joint Sealants: Sealing joints between window frames and adjacent construction.

D. Section 08 80 00 - Glazing.

1.03 REFERENCE STANDARDS

A. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for Windows, Doors, and Skylights; 2017.

B. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; 2015.

C. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).

D. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.

E. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

F. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

G. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2020.

H. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.

I. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.

J. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2016).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide component dimensions, information on glass and glazing, internal drainage details, and descriptions of hardware and accessories.

C. Shop Drawings: Indicate opening dimensions, elevations of different types, framed opening tolerances, method for achieving air and vapor barrier seal to adjacent construction, anchorage locations, and installation requirements.

D. Grade Substantiation: Prior to submitting shop drawings or starting fabrication, submit one of the following showing compliance with specified grade:
   1. Evidence of AAMA Certification.
   2. Evidence of WDMA Certification.
   3. Evidence of CSA Certification.

4. Test report(s) by independent testing agency itemizing compliance.

E. Test Reports: Prior to submitting shop drawings or starting fabrication, submit test report(s) by independent testing agency showing compliance with performance requirements in excess of those prescribed by specified grade.

F. Manufacturer's Qualification Statement.

G. Installer's Qualification Statement.

H. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner / Library's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of AAMA CW-10.

B. Protect finished surfaces with wrapping paper or strippable coating during installation. Do not use adhesive papers or sprayed coatings that bond to substrate when exposed to sunlight or weather.

1.08 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F.

B. Maintain this minimum temperature during and 24 hours after installation of sealants.

1.09 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

D. Provide ten year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: Kawneer North America; AA 6600 Thermal Window.

B. Other Acceptable - Aluminum Windows Manufacturers:
   1. Manko Window Systems, Inc: www.mankowindows.com/#sle.
   2. Oldcastle Building Envelope; www.oldcastlebe.com/#sle.
   3. Tubelite, Inc; www.tubeliteinc.com/#sle.TRACO: www.traco.com/#sle.
   4. Trulite Glass & Aluminum Solutions, LLC; www.trulite.com/#sle.
   5. Wausau Window and Wall Systems: www.wausauwindow.com/#sle.
   6. Or Approved Equal.

2.02 ALUMINUM WINDOWS

A. Aluminum Windows: Extruded aluminum frame and sash, factory fabricated, factory finished, with operating hardware, related flashings, and anchorage and attachment devices.
   1. Frame Depth: 6 inch.
   2. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for operating hardware and imposed loads.

3. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
4. Movement: Accommodate movement between window and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.
5. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
6. Thermal Movement: Design to accommodate thermal movement caused by 180 degrees F surface temperature without buckling stress on glass, joint seal failure, damaging loads on structural elements, damaging loads on fasteners, reduction in performance or other detrimental effects.

2.03 PERFORMANCE REQUIREMENTS

A. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 requirements for specific window type:
   1. Performance Class (PC): AW.

B. Design Pressure (DP): In accordance with ASCE 7.

C. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.

D. Water Leakage: No uncontrolled leakage on interior face when tested in accordance with ASTM E331 at differential pressure of 12.11 psf.

E. Air Leakage: 0.1 cfm/sq ft maximum leakage per unit area of outside window frame dimension when tested at 1.57 psf pressure difference in accordance with ASTM E283/E283M.

F. Condensation Resistance Factor of Frame: 50, measured in accordance with AAMA 1503.

G. Overall Thermal Transmittance (U-value): 0.35, maximum, including glazing, measured on window sizes required for this project.

2.04 COMPONENTS

A. Frames: 2 inch wide by 6 inch deep profile, of 2 inch thick section; thermally broken with interior portion of frame insulated from exterior portion; flush glass stops of snap-on type.

B. Glazing: See Section 08 80 00.

C. Fasteners: Stainless steel.

D. Glazing Materials: See Section 08 80 00.

E. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.

2.05 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.

B. Concealed Steel Items: Profiled to suit mullion sections; galvanized in accordance with ASTM A123/A123M.

2.06 FINISHES

A. Class I Color Anodized Finish: AAMA 611 AA-M12C22A42 Integrally colored anodic coating not less than 0.7 mils thick.

B. Finish Color: Medium Bronze Anodized.

C. Apply one coat of bituminous coating to concealed aluminum and steel surfaces in contact with dissimilar materials.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that wall openings and adjoining air and vapor seal materials are ready to receive aluminum windows.

3.02 INSTALLATION

A. Install windows in accordance with manufacturer's instructions.

B. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.

C. Align window plumb and level, free of warp or twist. Maintain dimensional tolerances and alignment with adjacent work.

D. Install sill and sill end angles.

E. Provide thermal isolation where components penetrate or disrupt building insulation. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

F. Install glass and infill panels in accordance with requirements specified in Section 08 80 00.

3.03 TOLERANCES

A. Maximum Variation from Level or Plumb: 1/16 inches every 3 ft non-cumulative or 1/8 inches per 10 ft, whichever is less.

3.04 CLEANING

A. Remove protective material from factory finished aluminum surfaces.

B. Wash surfaces by method recommended and acceptable to window manufacturer; rinse and wipe surfaces clean.

C. Remove excess glazing sealant by moderate use of mineral spirits or other solvent acceptable to sealant and window manufacturer.

END OF SECTION

SECTION 08 71 00 – DOOR HARDWARE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes:
   1. Mechanical and electrified door hardware for:

      a. Swinging doors.
   2. Field verification, preparation and modification of existing doors and frames to receive new door hardware.
   3. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier's responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.

B. Exclusions: Unless specifically listed in hardware sets, hardware is not specified in this section for:

   1. Windows
   2. Cabinets (casework), including locks in cabinets
   3. Signage
   4. Toilet accessories
   5. Overhead doors

C. Related Sections:
   1. Section 01 23 00 "Alternates" for alternates affecting this section.
   2. Section 06 10 00 "Rough Carpentry" for reinforcement walls for surface applied hardware.
   3. Section 06 20 00 "Finish Carpentry" for installation of door hardware.
   4. Section 07 92 00 "Joint Sealants" for sealant requirements applicable to threshold installation specified in this section.
   5. Section 08 11 00 "Metal Doors and Frames" for required reinforcements applicable to material specified in this section.
   6. Section 08 14 00 "Wood Doors" for applicable preparations for material specified in this section.
   7. Section 08 41 00 "Entrances and Storefronts" for applicable preparation for material specified in this section.
   8. Section 09 90 00 "Painting and Coating" for touchup, finishing or refinishing of existing openings modified by this section.
   9. Division 26 sections for connections to electrical power system and for low-voltage wiring.
   10. Division 28 sections for coordination with other components of electronic access control system.

1.03 REFERENCES

A. UL - Underwriters Laboratories

1. UL 10B - Fire Test of Door Assemblies
2. UL 10C - Positive Pressure Test of Fire Door Assemblies
3. UL 1784 - Air Leakage Tests of Door Assemblies
4. UL 305 - Panic Hardware

B. DHI - Door and Hardware Institute
1. Sequence and Format for the Hardware Schedule
2. Recommended Locations for Builders Hardware
3. Key Systems and Nomenclature
4. Installation Guide for Doors and Hardware

C. ANSI - American National Standards Institute
1. ANSI A117.1 (2017) – Accessible and Usable Buildings and Facilities
2. ANSI/BHMA A156.1 through A156.17; A156.19 through A156.26; and A156.29 through A156.37 – Standards for Commercial Hardware and Specialties
3. ANSI/BHMA A156.18 – Materials and Finishes
4. ANSI/BHMA A156.28 – Recommended Practices for Keying Systems
5. ANSI/WDMA I.S. 1A – Interior Architectural Wood Flush Doors
6. ANSI/SDI A250.8 – Standard Steel Doors and Frames

D. NFPA – National Fire Protection Association
1. NFPA 70 – National Electrical Code
2. NFPA 80 (2016) – Standard for Fire Doors and Other Opening Protectives
3. NFPA 101 – Life Safety Code
4. NFPA 105 – Standard for Smoke Door Assemblies and Other Opening Protectives
5. NFPA 252 – Fire Tests of Door Assemblies

1.04 SUBMITTALS

A. General:
1. Submit in accordance with Conditions of Contract and requirements of Section 01 33 00 “Submittal Procedures”.
2. Prior to forwarding submittal for architectural review:

   a. Comply with procedures for verifying existing door and frame compatibility for new hardware, as specified in PART 3, “EXAMINATION” article, herein.
   b. Review drawings and submittals from other trades to verify compatibility with specified hardware.
   c. Highlight, encircle, or otherwise specifically identify on submittals, deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.

B. Action Submittals:
1. Product Data: Furnish technical product data for each item of door hardware clearly marked and identified, illustrating and describing each product in the Hardware Schedule.

   a. Include construction and material descriptions showing finish and other information necessary to show compliance with specification requirements.
2. Wiring Diagrams: Furnish wiring details of electrified door hardware and building safety and security systems indicating:

   a. Elevation Drawings showing locations of electrified and access control door hardware with wire gages and quantities.
   b. Schematic diagrams of systems that interface with electrified door hardware, if necessary.

c. Point-To-Point wiring diagrams furnished by Div. 26 installer showing connections for each piece of electrified and access control door hardware.

3. Door Hardware Schedule: Prepared by or under the supervision of an Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) or, by a Door Hardware Technician (DHT).

   a. Submit schedule with hardware sets in vertical format as illustrated by Sequence and Format for the Hardware Schedule as published by the Door and Hardware Institute. Indicate complete designations of each item required for each door or opening, including:
      1) Door Index; include door number, heading number, and Architects hardware set number.
      2) Quantity, type, style, function, size, and finish of each hardware item.
      3) Handing of Pivots, Mortise Locks, Exit Devices and other items requiring special handing.
      4) Name and manufacturer of each item.
      5) Fastenings and other pertinent information required for proper installation.
      6) Location of each hardware set cross-referenced to indications on Drawings.
      7) Explanation of all abbreviations, symbols, and codes contained in schedule.
      8) Mounting locations for hardware.
      9) Door and frame sizes and materials.
      10) Degree of Swing and Handing.
      11) List of related door devices specified in other Sections for each opening.
      12) Operational Description of openings with any electrified hardware (locks, exits, electromagnetic locks, electric strikes, automatic operators, door position switches, magnetic holders or closer/holder units, and access control components).
         a) Operational description should include operational descriptions for: normal condition, product operation for ingress (access), fire/smoke alarm and power loss conditions, return to normal condition, and egress.

   b. Submittal Sequence: Submit door hardware schedule at earliest possible date concurrent with submissions of Product Data, Elevation Drawings and Samples. Coordinate submission of door hardware schedule with construction scheduling requirements, to facilitate fabrication of other work that is critical to the Project Construction Schedule.

4. Key Schedule:

   a. After Keying Conference, provide keying schedule listing levels of keying as well as explanation of key system's function, key symbols used and door numbers controlled.
   b. Use ANSI/BHMA A156.28 “Recommended Practices for Keying Systems” as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
   c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
   d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
   e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion.
      1) Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.

   f. Prepare key schedule by or under supervision of supplier, detailing Owner’s final keying instructions for locks.

5. Templates: After final approval of hardware schedule, provide templates for doors, frames and other work specified to be factory or shop prepared for door hardware installation.

C. Informational Submittals:
   1. Qualification Data: For Supplier, Installer and Architectural Hardware Consultant.
   2. Product data for electrified door hardware:

a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
3. Warranty: Special warranty specified in this Section.

D. Closeout Submittals:
1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:

a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
b. Catalog pages for each product.
c. Factory order acknowledgement numbers (for warranty and service)
d. Name, address, and phone number of local representative for each manufacturer.
e. Parts list for each product.
f. Final approved hardware schedule, edited to reflect conditions as-installed.
g. Final keying schedule
h. Copies of floor plans with keying nomenclature
i. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.
j. Copy of warranties including appropriate reference numbers for manufacturers to identify project.

E. Inspection and Testing:
1. Submit a written report of the results of functional testing and inspection for each fire door assembly in compliance with NFPA 80.

a. Written report to be provided to the Owner and be made available to the Authority Having Jurisdiction (AHJ).
b. Report to include the door number for each fire door assembly, door location, door and frame material, fire rating and, summary of deficiencies if any.
2. Submit a written report of the results for the functional testing and inspection for each required egress door assembly, in compliance with NFPA 101.

a. Written report to be provided to the Owner and made available to the Authority Having Jurisdiction (AHJ).
b. Report to include the door number for each required egress door assembly, door location, door and frame material and, summary of deficiencies if any.

1.05 QUALITY ASSURANCE

A. Qualifications and Responsibilities:
1. Supplier Qualifications and Responsibilities:

a. Recognized architectural hardware supplier with record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project.
b. Hardware supplier to have on staff a certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) available to Owner, Architect, and Contractor, at reasonable times during the Work, for consultation.
c. Warehousing Facilities: In Project's vicinity.
d. Obtain each type of hardware directly from a single manufacturer.
e. Scheduling Responsibilities:
1) Preparation of door hardware and keying schedules
2) Preparation of data for electrified door hardware including Electrical Diagram Drawings similar to those indicated in this Project.
f. Coordination Responsibility:

1) Provide installation and technical data to Architect and other related sub-contractors.
2) Assist in coordinating installation of electronic security hardware with Architect, electrical engineers and installers.

g. Upon completion of electronic security hardware installation, inspect and verify that all electrified hardware components are working properly.

2. Hardware Consultant Qualifications:

a. Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:
1) DHI Certified Architectural Hardware Consultant (AHC) or, Door Hardware Consultant (DHC).
2) Can provide installation and technical data to Architect and other related subcontractors.
3) Can inspect and verify components are inworking order upon completion of installation.
4) Capable of producing wiring diagrams
5) Capable of coordinating installation of electrified hardware with Architect and Electrical Engineers.

3. Installer Qualifications:

a. Experienced installing commercial door hardware in projects of similar scope and size with a record of successful in-service performance.
1) Lead Installer minimum 5 years;
2) Assistant Installers minimum 2 years.
3) Maximum apprentice installers: 1.

B. Certifications:
1. Fire-Rated Door Openings:

a. Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction.
b. Provide only items of door hardware that are listed products tested by Underwriters Laboratories, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated.
c. Hardware based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.

2. Smoke and Draft Control Door Assemblies

a. Provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 80.
b. Comply with the maximum air leakage of 0.3 cfm/sq. ft. (3 cu m per minute/sq m) at tested pressure differential of 0.3-inch wg (75 Pa) of water.

3. Electrified Door Hardware:

a. Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.

4. Accessibility Requirements:

a. For door hardware on doors in an accessible route, comply with ANSI A117.1 – Accessible and Useable Buildings and Facilities governing accessibility regulations.

C. Pre-Installation Meetings
1. Keying Conference:

a. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:

1) Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
2) Preliminary key system schematic diagram.
3) Requirements for key control system.
4) Requirements for access control.
5) Address for delivery of keys.

2. Pre-installation Conference

   a. Participants to include: Contractor, Installation Supervisor, Lead Installer, Hardware Supplier, Access Control Supervisor and Access Control Lead Installer
      1) Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
      2) Review Hardware Schedule and Access Control Schedule to confirm alignment of electrified products.
      3) Inspect frames and discuss preparatory work performed by other trades.
      4) Inspect and discuss electrical roughing-in for electrified door hardware.
      5) Review sequence of operation for each type of electrified door hardware.
      6) Review any special product installation requirements or installation sequences.
      7) Review required testing, inspecting, and certifying procedures.
      8) Review questions or concerns related to proper installation and adjustment of door hardware.

3. Electrified Hardware Coordination Conference:

   a. Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.
      1) Verify and confirm who is furnishing and who is installing each type of electrified hardware.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Tag each item or package separately with opening number identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.
   1. Deliver each article of hardware in manufacturer’s original packaging.
   2. Furnish complete packing list with each delivery showing quantity and type of product delivered and opening number(s).

B. Jointly inventory door hardware with hardware supplier upon receipt.

C. Aluminum Door Hardware:
   1. Separate and deliver hardware for aluminum doors as requested by door supplier.

D. Project Conditions:
   1. Provide secure lock-up for door hardware delivered to Project. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.

      a. Organize and store products on shelving
      b. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.

E. Protection and Damage:
   1. Promptly replace products damaged during shipping.

2. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work.
3. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.

F. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.07 COORDINATION

A. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

B. Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

C. Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

D. Where existing doors, frames and/or hardware are to remain, field verify existing functions, conditions and preparations. Coordinate existing opening conditions with newly specified hardware and inform architect of potential conflict with proper door operation.

1.08 WARRANTY

A. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
1. Warranty Period: Beginning from date of Substantial Completion, for durations indicated.
   a. Mechanical Warranty:
      1) Locks: 10 Years
      2) Exit Devices: 3 Years
      3) Closers: 30 Years
   b. Electrical Warranty
      1) Locks: 1 Year
      2) Exit Devices: 1 Year
      3) Automatic Operators: 2 Years
   c. Continuous Hinges: Lifetime
   d. Key Blanks: Lifetime
2. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.

1.09 MAINTENANCE

A. Maintenance Tools: Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Characteristics and project suitability to ensure continuity of existing and future performance and maintenance standards. These products are specified with the notation: “No Substitute.”
   1. Where “No Substitute” is noted, submittals and substitution requests for other products will not be considered.

B. Approval of manufacturers and/or products other than those listed as “Scheduled Manufacturer” in the individual article for the product category shall be in accordance with QUALITY ASSURANCE article, herein.

C. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.02 MATERIALS

A. Fasteners
   1. Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.
   2. Furnish screws for installation with each hardware item. Finish exposed (exposed under any condition) screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
   3. Provide concealed fasteners for hardware units exposed when door is closed except when no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless thru-bolts are required to fasten hardware securely. Review door specification and advise Architect if thru bolts are required.
   4. Install hardware with fasteners provided by hardware manufacturer.

B. Modification and Preparation of Existing Doors: Where existing door hardware is indicated to be removed and reinstalled.
   1. Provide necessary fillers, Dutchmen, reinforcements, and fasteners, compatible with existing materials, as required for mounting new opening hardware and to cover existing door and frame preparations.
   2. Use materials which match materials of adjacent modified areas.
   3. When modifying existing fire-rated openings, provide materials permitted by NFPA 80 as required to maintain fire-rating.

C. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.
   1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

D. Cable and Connectors: Hardwired Electronic Access Control Lockset and Exit Device Trim:
   1. Data: 24AWG, 4 conductor shielded, Belden 9843, 9841 or comparable.
   2. DC Power: 18 AWG, 2 conductor, Belden 8760 or comparable.
   3. Provide type of data and DC power cabling required by access control device manufacturer for this installation.
   4. Where scheduled in the hardware sets, provide each item of electrified hardware and wire harnesses with enough and wire gauge with standardized Molex plug connectors to accommodate electric function of specified hardware. Provide Molex connectors that plug directly

into connectors from harnesses, electric locking and power transfer devices. Provide through-door wire harness for each electrified locking device installed in a door and wire harness for each electrified hinge, electrified continuous hinge, electrified pivot, and electric power transfer for connection to power supplies.

2.03 HINGES

A. Manufacturers and Products:
   1. Scheduled Manufacturer and Product:
      a. Ives 5BB series
   2. Acceptable Manufacturers and Products:
      a. Hager BB series
      b. Stanley (Best) FBB series.

B. Requirements:
   1. Provide hinges conforming to ANSI/BHMA A156.1.
   2. Provide five knuckle, ball bearing hinges.
   3. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:
      a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
      b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high
   4. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) up to and including 42 inches (1067 mm) wide:
      a. Exterior: Heavy weight, bronze/stainless steel, 4-1/2 inches (114 mm) high
      b. Interior: Heavy weight, steel, 4-1/2 inches (114 mm) high
   5. Adjust hinge width for door, frame, and wall conditions to allow proper degree of opening.
   6. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
   7. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
      a. Out-Swinging Exterior Doors: Non-removable pins
      b. Out-Swinging Interior Lockable Doors: Non-removable pins

2.04 CONTINUOUS HINGES

A. Manufacturers:
   1. Scheduled Manufacturer:
      a. Ives
   2. Acceptable Manufacturers:
      a. ABH
      b. Markar

B. Requirements:
   1. Provide aluminum geared continuous hinges conforming to ANSI/BHMA A156.26, Grade 1.
   2. Provide aluminum geared continuous hinges, where specified in the hardware sets, fabricated from 6063-T6 aluminum.
   3. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.
   4. Provide hinges capable of supporting door weights up to 450 pounds, and successfully tested for 1,500,000 cycles.
   5. Provide aluminum geared continuous hinges with electrified option scheduled in the hardware sets. Provide with enough and wire gage to accommodate electric function of specified hardware.
   6. Provide hinges 1 inch (25 mm) shorter in length than nominal height of door, unless otherwise noted or door details require shorter length and with symmetrical hole pattern.

2.05 ELECTRIC POWER TRANSFER

A. Manufacturers:
   1. Scheduled Manufacturer and Product:
      a. Von Duprin EPT-10
   2. Acceptable Manufacturers and Products:
      a. ABH PT1000
      b. Securitron CEPT

B. Requirements:
   1. Provide power transfer with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.
   2. Locate electric power transfer per manufacturer's template and UL requirements, unless interference with operation of door or other hardware items.

2.06 PIVOT SETS

A. Manufacturers:
   1. Scheduled Manufacturer:
      a. Ives
   2. Acceptable Manufacturers:
      a. Rixson

B. Requirements:
   1. Provide pivot sets complete with oil-impregnated top pivot, unless indicated otherwise.
   2. Where offset pivots are specified, Provide one intermediate pivot for doors less than 91 inches (2311 mm) high and one additional intermediate pivot per leaf for each additional 30 inches (762 mm) in height or fraction thereof. Intermediate pivots spaced equally not less than 25 inches (635 mm) or not more than 35 inches (889 mm) on center, for doors over 121 inches (3073 mm) high.
   3. Provide appropriate model where pivot sets are scheduled at fire rated openings.

2.07 FLUSH BOLTS

A. Manufacturers:
   1. Scheduled Manufacturer:
      a. Ives
   2. Acceptable Manufacturers:
      a. Burns Manufacturing
      b. Rockwood Manufacturing

B. Requirements:
   1. Provide manual flush bolts with forged bronze or stainless-steel face plates, extruded brass levers, and with wrought brass guides and strikes. Provide 12 inch (305 mm) steel or brass rods at doors up to 90 inches (2286 mm) in height. For doors over 90 inches (2286 mm) in height increase top rods by 6 inches (152 mm) for each additional 6 inches (152 mm) of door height. Provide dust-proof strikes at each bottom flush bolt.

2.08 CYLINDRICAL LOCKS – GRADE 1

A. Manufacturers and Products:
   1. Scheduled Manufacturer and Product:
      a. Schlage ND series

2. Acceptable Manufacturers and Products:
   a. No Substitute

B. Requirements:
1. Provide cylindrical locks conforming to ANSI/BHMA A156.2 Series 4000, Grade 1, and UL Listed for 3-hour fire doors.
2. Cylinders: Refer to “KEYING” article, herein.
3. Provide locks with standard 2-3/4 inches (70 mm) backset, unless noted otherwise, with 1/2-inch latch throw. Provide proper latch throw for UL listing at pairs.
4. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
5. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
6. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
7. Lever Trim: Solid cast levers without plastic inserts and wrought roses on both sides.
   a. Lever Design: Sparta

2.09 EXIT DEVICES

A. Manufacturers and Products:
   1. Scheduled Manufacturer and Product:
      a. Von Duprin 99/33A series
   2. Acceptable Manufacturers and Products:
      a. No Substitute

B. Requirements:
1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1 and UL listed for Panic Exit or Fire Exit Hardware.
2. Cylinders: Refer to “KEYING” article, herein.
3. Provide grooved touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
4. Touchpad must extend a minimum of one half of door width. No plastic inserts are allowed in touchpads.
5. Provide exit devices with dead-latching feature for security and for future addition of alarm kits and/or other electrified requirements.
6. Provide exit devices with weather resistant components that can withstand harsh conditions of various climates and corrosive cleaners used in outdoor pool environments.
7. Provide flush end caps for exit devices.
8. Provide exit devices with manufacturer’s approved strikes.
9. Provide exit devices cut to door width and height. Install exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
10. Mount mechanism case flush on face of doors or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.

2.10 EXIT DEVICES – BAR TYPE

A. Manufacturers and Products:
   1. Scheduled Manufacturer and Product:
      a. Falcon 1990
   2. Acceptable Manufacturers and Products:
      a. No Substitute

B. Requirements:
1. Provide narrow stile exit devices tested to ANSI/BHMA A156.3 Grade 1.

2. Cylinders: Refer to “KEYING” article, herein.
3. Provide bar type exit devices, aluminum material with standard architectural finishes to match balance of the door hardware.
4. Latch Bolt Throw: 3/4 inch (19 mm) for rim and mortise devices, 5/8 inch (16 mm) for concealed vertical rod devices.
5. Mechanism Case: One piece without cover plate. Mount flush on face of doors or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
6. Provide manufacturer’s standard strikes.
7. Provide exit devices cut to door width and height. Locate exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
8. Furnish all necessary wood door kits and cover plates, for proper installation.

2.11 POWER SUPPLIES

A. Manufacturers and Products:
   1. Scheduled Manufacturer and Product:
      a. Von Duprin PS900 Series
   2. Acceptable Manufacturers and Products:
      a. No Substitute

B. Requirements:
   1. Provide power supplies approved by manufacturer of supplied electrified hardware.
   2. Provide appropriate quantity of power supplies necessary for proper operation of electrified locking components as recommended by manufacturer of electrified locking components with consideration for each electrified component using power supply, location of power supply, and approved wiring diagrams. Locate power supplies as directed by Architect.
   3. Provide regulated and filtered 24 VDC power supply, and UL class 2 listed.
   4. Provide power supplies with the following features:
      a. 12/24 VDC Output, field selectable.
      b. Class 2 Rated power limited output.
      c. Universal 120-240 VAC input.
      d. Low voltage DC, regulated and filtered.
      e. Polarized connector for distribution boards.
      f. Fused primary input.
      g. AC input and DC output monitoring circuit w/LED indicators.
      h. Cover mounted AC Input indication.
      i. Tested and certified to meet UL294.
      j. NEMA 1 enclosure.
      k. Hinged cover w/lock down screws.
      l. High voltage protective cover.

2.12 CYLINDER HOUSINGS & CORES

A. Manufacturers and Products:
   1. Scheduled Manufacturer and Product:
      a. Schlage
   2. Acceptable Manufacturers and Products:
      a. Best

B. Requirements:
   1. Provide cylinders compliant with ANSI/BHMA A156.5; latest revision; cylinder face finished to match lockset; manufacturer’s series as indicated. Refer to “KEYING” article, herein.

2. Provide cylinders in the below-listed configuration(s), distributed throughout the Project as indicated.
   a. Conventional Patented Restricted Small Format: cylinder with small format interchangeable cores (SFIC).

C. Manufacturers and Products:
   1. Scheduled Manufacturer and Product:
      a. Best SFIC Core
   2. Acceptable Manufacturers and Products:
      a. No Substitute

D. Requirements:
   1. Provide Cores in the below-listed configuration(s), distributed throughout the Project as indicated.
      a. Conventional Patented Restricted Small Format: Small format interchangeable cores (SFIC).
   2. Nickel silver bottom pins.

E. Construction Keying:
   1. Temporary Construction Cylinder Keying.
      a. Provide construction cores that permit voiding construction keys without cylinder removal, furnished in accordance with the following requirements.
         1) Split Key or Lost Ball Construction Keying System.
         2) 3 construction control keys, and extractor tools or keys as required to void construction keying.
         3) 12 construction change (day) keys.
      b. Owner or Owner's Representative will void operation of temporary construction keys.
   2. Replaceable Construction Cores.
      a. Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
         1) 3 construction control keys
         2) 12 construction change (day) keys.
      b. Owner or Owner's Representative will replace temporary construction cores with permanent cores.

2.13 KEYING

A. Non-factory existing system: Provide cylinders/cores keyed into Owner's existing keying system managed by Owner's locksmith, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference. Contact:
   1. Firm Name:
   2. Contact Person:
   3. Telephone:

B. Requirements:
   1. Provide permanent cylinders/cores keyed by the manufacturer according to the following key system.
      a. Master Keying system as directed by the Owner.
   2. Forward bitting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements will be cause for replacement of cylinders/cores involved at no additional cost to Owner.
   3. Provide keys with the following features:
      a. Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
      b. Patent Protection: Keys and blanks protected by one or more utility patent(s).
   4. Identification:

a. Mark permanent cylinders/cores and keys with applicable blind code for identification. Do not provide blind code marks with actual key cuts.
b. Identification stamping provisions must be approved by the Architect and Owner.
c. Stamp cylinders/cores and keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE" along with the "PATENTED" or patent number to enforce the patent protection.
d. Failure to comply with stamping requirements will be cause for replacement of keys involved at no additional cost to Owner.
e. Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.

5. Quantity: Furnish in the following quantities.
   a. Change (Day) Keys: 3 per cylinder/core.
   b. SFIC: Permanent Control Keys: 3.
   c. Master Keys: 6 per master key group.

2.14 KEY CONTROL SYSTEM

A. Manufacturers:
   1. Scheduled Manufacturer:
      a. Telkee
   2. Acceptable Manufacturers:
      a. Lund Industries

B. Requirements:
   1. Provide key control system, including envelopes, labels, tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet, all as recommended by system manufacturer, with capacity for 150% of number of locks required for Project.
      a. Provide complete cross index system set up by hardware supplier, and place keys on markers and hooks in cabinet as determined by final key schedule.
      b. Provide hinged-panel type cabinet for wall mounting.

2.15 DOOR CLOSERS

A. Manufacturers and Products:
   1. Scheduled Manufacturer and Product:
      a. LCN 4040XP series
   2. Acceptable Manufacturers and Products:
      a. No Substitute

B. Requirements:
   1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
   2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
   3. Cylinder Body: 1-1/2-inch (38 mm) diameter with 5/8-inch (16 mm) diameter double heat-treated pinion journal.
   4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
   5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.

6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.
7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.16 ELECTRO-MECHANICAL AUTOMATIC OPERATORS

A. Manufacturers and Products:
   1. Scheduled Manufacturer and Product:
      a. LCN Senior Swing
   2. Acceptable Manufacturers and Products:
      a. Stanley Magic Force

B. Requirements:
   1. Provide low energy automatic operator units that are electro-mechanical design complying with ANSI/BHMA A156.19.
      a. Opening: Powered by DC motor working through reduction gears.
      b. Closing: Spring force.
      c. Manual, hydraulic, or chain drive closers: Not permitted.
      d. Operation: Motor is off when door is in closing mode. Door can be manually operated with power on or off without damage to operator. Provide variable adjustments, including opening and closing speed adjustment.
      e. Cover: Aluminum.
   2. Provide units with manual off/auto/hold-open switch, push and go function to activate power operator, vestibule interface delay, electric lock delay, hold-open delay adjustable from 1 to 32 seconds, and logic terminal to interface with accessories, mats, and sensors.
   3. Provide drop plates, brackets, and adapters for arms as required to suit details.
   4. Provide hard-wired motion sensors and/or actuator switches, and receivers for operation as specified. Provide weather-resistant actuators at exterior applications.
   5. Provide complete assemblies of controls, switches, power supplies, relays, and parts/material recommended and approved by manufacturer of automatic operator for each individual leaf. Actuators control both doors simultaneously at pairs. Sequence operation of exterior and vestibule doors with automatic operators to allow ingress or egress through both sets of openings as directed by Architect. Locate actuators, key switches, and other controls as directed by Architect.

C. ACTUATORS Manufacturers:
   1. Scheduled Manufacturer:
      a. LCN
   2. Acceptable Manufacturers:
      a. MS-Sedco

D. Requirements:
   1. Provide actuators as specified in the hardware groups.

2.17 DOOR TRIM

A. Manufacturers:
   1. Scheduled Manufacturer:
      a. Ives.
   2. Acceptable Manufacturers:
      a. Burns Manufacturing
      b. Rockwood Manufacturing

B. Requirements:
   1. Provide push plates, push bars, pull plates, and pulls with diameter and length as scheduled.

2.18 PROTECTION PLATES

A. Manufacturers:
   1. Scheduled Manufacturer:
      a. Ives
   2. Acceptable Manufacturers:
      a. Burns Manufacturing
      b. Rockwood Manufacturing

B. Requirements:
   1. Provide protection plates with a minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
   2. Sizes plates 2 inches (51 mm) less width of door on single doors, pairs of doors with a mullion, and doors with edge guards. Size plates 1 inch (25 mm) less width of door on pairs without a mullion or edge guards.
   3. At fire rated doors, provide protection plates mounted over 16 inches high from the bottom of the door with UL label.

2.19 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

A. Manufacturers:
   1. Scheduled Manufacturers:
      a. Glynn-Johnson
   2. Acceptable Manufacturers:
      a. ABH
      b. Rixson

B. Requirements:
   1. Provide overhead stop at any door where conditions do not allow for a wall stop or, where floor stop presents tripping hazard.
   2. Provide friction type at doors without closer and positive type at doors with closer.

2.20 DOOR STOPS AND HOLDERS

A. Manufacturers:
   1. Scheduled Manufacturer:
      a. Ives
   2. Acceptable Manufacturers:
      a. ABH Manufacturing
      b. Burns Manufacturing

c. Rockwood Manufacturing

B. Provide door stops at each door leaf:
1. Provide wall stops wherever possible. Provide concave type where lockset has a push button of thumb turn.
2. Where a wall stop cannot be used, provide universal floor stops.
3. Where wall or floor stop cannot be used, provide overhead stop.
4. Provide roller bumper where doors open into each other and overhead stop cannot be used.

2.21 THRESHOLDS

A. Requirements:
1. Provide threshold of Extruded Aluminum 1/2 inch (13 mm) high, minimum of 5 inches (127 mm) deep, or as shown in architectural details.
2. Furnish threshold full width of door opening plus jamb face.
3. Furnish appropriate fasteners for attachment to substrate.
   a. Flat (Saddle) Thresholds:
      1) Scheduled Manufacturer and Product: Zero International #655A

2.22 DOOR SEALS

A. Smoke Seal
1. Scheduled Manufacturer and Product: Zero International 488S
   a. Requirements:
      1) Provide Self-Adhesive Silicone Smoke seal for full perimeter of door opening.
      2) Furnish with pressure sensitive adhesive protected by a release liner that has high initial adhesion and long-term holding power from -30° to 150°.
      3) Provide product certified by Underwriters Laboratories 10B & 10C for Fire and Smoke & Draft Control.

B. Weatherstripping
1. Scheduled Manufacturer: Zero International #429AA-S
   a. Requirements:
      1) Provide Flat Bar-Type weatherstripping to completely seal the perimeter of the opening.
      2) Utilize aluminum alloy 6063-T5 or -T6 with anodized finish as indicated in the hardware group.
      3) Furnish with Rubberized Silicone insert with a heat tolerance from -20 to 180 degrees Fahrenheit.
      4) Furnish with self-drilling TEK or sheet metal screws.

C. Sweeps
1. Scheduled Manufacturer: Zero International #8197AA as shown in the hardware sets.
   a. Requirements:
      1) Provide sweeps to completely seal the bottom of the door to the threshold and extend the seal partially across the face of the frame at the hinge and lock stiles.
      2) Utilize aluminum alloy 6063-T5 or -T6 with anodized finish as indicated in the hardware group.
      3) Furnish with Neoprene insert which is easily replaceable and readily available.
      4) Furnish with self-drilling TEK or sheet metal screws.

2.23 DRIP CAPS

A. Manufacturers:
   1. Scheduled Manufacturer and Product: Zero International #142AA

B. Requirements:
   1. Provide Drip caps that extend the full width of the door opening frame.
   2. Utilize aluminum alloy 6063-T5 or -T6 with anodized finish as listed in the hardware group.
   3. Furnish self-drilling TEK or sheet metal screws.

2.24 SILENCERS

A. Manufacturers:
   1. Scheduled Manufacturer and Product: Ives #SR64

B. Requirements:
   1. Provide "push-in" type silencers for hollow metal or wood frames.
   2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
   3. Omit where gasketing is specified.

2.25 DOOR POSITION SWITCHES

A. Manufacturers:
   1. Scheduled Manufacturer:
      a. Schlage
   2. Acceptable Manufacturers:
      a. George Risk Industries

B. Requirements:
   1. Provide recessed or surface mounted type door position switches as specified.
   2. Coordinate door and frame preparations with door and frame suppliers. If switches are being used with magnetic locking device, provide minimum of 4 inches (102 mm) between switch and magnetic locking device.

2.26 COAT HOOKS

A. Manufacturers:
   1. Scheduled Manufacturer:
      a. Ives
   2. Acceptable Manufacturers:
      a. Burns Manufacturing
      b. Rockwood Manufacturing

B. Provide coat hooks as specified.

2.27 FINISHES

A. Finish: BHMA 626/652 (US26D) – Satin Chrome on Brass or Bronze / Steel.; except:
   1. Hinges at Exterior Doors: BHMA 630 (US32D) – Satin Stainless Steel

2. Continuous Hinges: BHMA 628 (US28) – Clear Anodized Aluminum
3. Power Transfers: BHMA 689 – Aluminum Powder Coat
4. Push Plates, Pulls: BHMA 630 (US32D) – Satin Stainless Steel
5. Auto Operators: BHMA 628 (US28) – Clear Anodized Aluminum
6. Protection Plates: BHMA 630 (US32D) – Stain Stainless Steel
7. Overhead Stops and Holders: BHMA 630 (US32D) – Satin Stainless Steel
8. Door Closers: BHMA 689 (ALUM or LA)– Aluminum Powder Coat
9. Wall Stops: BHMA 630 (US32D) – Satin Stainless Steel
10. Actuators: BHMA 630 (US32D) – Satin Stainless Steel
11. Weatherstripping: BHMA 628 (US28) – Clear Anodized Aluminum
12. Thresholds: BHMA 719 (US27) – Mill Finish Aluminum
13. Smoke Seal: Black
14. Silencers: Gray
15. Power Supplies: Gray

PART 3 - EXECUTION

3.01 EXAMINATION

A. Prior to installation of hardware, examine doors and frames, with Installer present, to ensure frames are installed Plumb, Level, Square and True, and the floor is level throughout the swing of the door.

B. Inspect labeled openings for proper fire-rating label, door assembly construction, wall and floor construction, and other conditions affecting performance. Verify doors, frames and wall have been properly reinforced for hardware installation.

C. Confirm finishing of all frames and doors, and wash-down of concrete has been completed before beginning hardware installation.

D. Field verify existing doors and frames receiving new hardware and existing conditions receiving new openings have been properly prepared to receive new material. Verify that new hardware is compatible with existing conditions and, door and frame preparations.

E. Examine rough-in for electrical power systems and verify actual locations of wiring connections before electrified door hardware installation.

F. Report unsatisfactory conditions to Architect. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Hollow Metal Doors and Frames: For surface-applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6

B. Wood Doors: Comply with door and hardware manufacturers' written instructions

3.03 PREPARATION OF EXISTING FRAMES AND DOORS

A. Where on-site modification of doors and frames is required:

1. Carefully remove existing door hardware and components being reused. Clean, protect, tag, and store in accordance with storage and handling requirements specified herein.
2. Field modify and prepare existing door and frame for new hardware being installed.
3. When modifications are exposed to view, use concealed fasteners, when possible.
4. Prepare hardware locations and reinstall in accordance with installation requirements for new door hardware and with:

3.04 INSTALLATION

A. Mount door hardware units at heights to comply with one of the following, unless otherwise indicated or required to comply with governing regulations.
   1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
   2. Custom Steel Doors and Frames: HMMA 831.
   3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each hardware item in compliance with manufacturer’s instructions and recommendations, using only fasteners provided by manufacturer.

C. Reinforce drywall partitions for surface applied door stops or holders.

D. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.

E. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.

F. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

G. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.

H. Hinges and Pivots: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated.

I. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches (750 mm) of door height greater than 90 inches (2286 mm).

J. Wiring: Coordinate with Division 26, ELECTRICAL sections for:
   1. Conduit, junction boxes and wire pulls.
   2. Connections to and from power supplies to electrified hardware.
   3. Connections to fire/smoke alarm system and smoke evacuation system.
   4. Connection of wire to door position switches and wire runs to central room or area, as directed by Architect.
   5. Testing and labeling wires with Architect’s opening number.

K. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

L. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Mount closers so they are not visible in corridors, lobbies and other public spaces unless approved by Architect.
   1. Install self-limiting closers for maximum degree of swing
   2. Adjust closers immediately upon installation to conform with manufacturer's printed instructions and set latch speed to assure unassisted positive latching.

M. Automatic Operators: Sequence operation of exterior and vestibule doors with automatic operators installed to allow ingress or egress through both sets of openings with the activation of a single motion.
   1. Locate actuators, key switches or other controls as directed by the architect.

N. Protection Plates: Install each protection plate with a thinly spread layer of mastic in its center to assure even contact before fastening with screws. Set bottom edge of plate flush with door bottom.

O. Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room. Verify location with Architect.

P. Stops: Provide wall stops for all doors unless floor or other type stops are indicated in door hardware schedule.
   1. Do not mount floor stops where they may impede traffic or present tripping hazard.

Q. Thresholds: Cope thresholds to match and tightly fit frame profile. Set in full bed of sealant and seal edges to frame complying with requirements specified in Section 07 92 00 "Joint Sealants".

R. Perimeter Gasketing: Cut and fit all gasketing applied to head and jamb forming a complete seal between door and frame.
   1. Do not notch perimeter gasketing for surface applied hardware.

S. Door Sweeps: Apply to bottom of door, forming seal with threshold when door is closed. Seal exterior applied door bottom with silicone caulk to ensure continuously filled seam.

T. Drip Caps: Apply to exterior face of frame head extending to full width of door frame. Seal with silicone caulk to ensure continuously filled seam.

3.05 FIELD QUALITY CONTROL

A. Inspection and Testing:
   1. Provide Function testing and inspection of Fire Door Assemblies by a qualified person in accordance with NFPA 80.

      a. Schedule fire door assembly inspection within 90 days of Substantial Completion of the Project.
      b. Submit a signed, written final report as specified in Paragraph 1.04.E.1
      c. Correct all deficiencies and schedule a reinspection of fire door assembles noted as deficient on the initial inspection report
      d. Inspector to reinspect fore doors assemblies after repairs are made.
      e. No deficiencies of fire door assemblies are to be present at time of completion.
   2. Provide inspection of required egress door assemblies by a qualified person in accordance with NFPA 101

      a. Schedule egress door assembly inspection within 90 days of Substantial Completion of the Project for the required openings.
      b. Submit a signed, written final report as specified in Paragraph 1.04.E.2

c. Correct all deficiencies and schedule a reinspection of egress door assembles noted as deficient on the inspection report.
d. Inspector to reinspect required egress door assemblies after repairs are made.

B. Engage qualified, manufacturer trained representative to perform inspections and to prepare inspection reports.
1. Representative will inspect door hardware and state in each report whether installed work complies with or deviates from hardware schedule, manufacturer's installation requirements and include whether door hardware is properly adjusted.

3.06 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware at each door to ensure proper operation and smooth function of every unit. Replace units that cannot be adjusted to operate as intended.
1. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
2. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
3. Exit Devices: Adjust immediately upon installation in conformance with manufacturer's printed instructions.

B. Occupancy Adjustment: Approximately three months after date of Substantial Completion, Installer must examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure proper function of doors and door hardware.

3.07 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration until time of Substantial Completion.

3.08 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance and, removal replacement of door hardware.

3.09 DOOR HARDWARE SCHEDULE

A. Hardware items are referenced in the following hardware groups. Refer to the above-specifications for special features, options, cylinders/keying, and other requirements.

B. The hardware sets listed below represent the design intent and direction of the Owner and Architect for interior and exterior doors. These hardware sets are used to establish a type, continuity and standard of quality. They are a guideline only and should not be considered a detailed hardware schedule. It is the door hardware supplier's responsibility to thoroughly review existing conditions,

schedules, specifications, drawings, and other Contract Documents to verify the suitability and proper functioning of the hardware items specified herein.

C. Discrepancies, conflicting hardware and missing items should be brought to the attention of the Architect with proposed solutions. Omitted items critical to opening operation or function should be scheduled with the appropriate additional hardware for the proper application and brought to the attention of the architect.

D. Manufacturer's Abbreviation List:

1. (GLY) - Glynn-Johnson
2. (IVE) - Ives
3. (LCN) - LCN Closers
4. (SCH) - Schlage Locks
5. (SCE) - Schlage Electronics
6. (TEL) - Telkee Products
7. (VON) - Von Duprin
8. (ZER) - Zero International

E. Hardware Sets:

Legend:

Link to catalog cut sheet.

Hardware Group No. 01

For use on Door #(s):
143.1

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	CLASSROOM LOCK	ND70BD SPA		626	SCH
1	EA	BEST SFIC CORE	1C-7		626	BES
1	EA	SURFACE CLOSER	4040XP RW/PA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 02

For use on Door #(s):
121.1 174.1

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50BD SPA		626	SCH
1	EA	BEST SFIC CORE	1C-7		626	BES
1	EA	OH STOP	90S		630	GLY
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 03

For use on Door #(s):
119.1 162.1

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	CLASSROOM LOCK	ND70BD SPA		626	SCH
1	EA	BEST SFIC CORE	1C-7		626	BES
1	EA	SURFACE CLOSER	4040XP RW/PA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	SEALS	ALL SEALS BY ALUMINUM FRAME MANAFACTURER		BLK	BYO

Hardware Group No. 04

For use on Door #(s):
154A.1

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	STOREROOM LOCK	ND80BD SPA		626	SCH
1	EA	BEST SFIC CORE	1C-7		626	BES
1	EA	OH STOP	90S		630	GLY
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 05

For use on Door #(s):
154

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 5 X 4.5 NRP		652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50BD SPA		626	SCH
1	EA	BEST SFIC CORE	1C-7		626	BES
1	EA	OH STOP	90S		630	GLY
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 06

For use on Door #(s):
147

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	STOREROOM LOCK	ND80BD SPA		626	SCH
1	EA	BEST SFIC CORE	1C-7		626	BES
1	EA	WALL STOP	WS406/407CCV		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 07

For use on Door #(s):
146.1

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5		652	IVE
1	EA	FIRE EXIT HARDWARE	99-L-BE-F-17		626	VON
1	EA	SURFACE CLOSER	4040XP RW/PA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	488SBK PSA		BLK	ZER

Hardware Group No. 08

For use on Door #(s):

138A.1

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	CLASSROOM LOCK	ND70BD SPA		626	SCH
1	EA	BEST SFIC CORE	1C-7		626	BES
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	SEALS	ALL SEALS BY ALUMINUM FRAME MANAFACTURER		BLK	BYO

Hardware Group No. 09

For use on Door #(s):

102.1 124.1 125.1 126.1

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	PRIVACY LOCK W/ OUTSIDE INDICATOR	L9496 with XL13-439		626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	488SBK PSA		BLK	ZER
1	EA	COAT AND HAT HOOK	582		626	IVE

Hardware Group No. 10

For use on Door #(s):

E150.1 E152.1 E161.1 E162.1 E162.2 E163.1
E169.1 E170.1 E171.1 E172.1 E202A.1 E203A.1
E265.1

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CLASSROOM LOCK	ND70BD SPA		626	SCH
1	EA	BEST SFIC CORE	1C-7		626	BES

ALL OTHER EXISTING HARDWARE TO REMAIN

Hardware Group No. 11

For use on Door #(s):
E166.1 E203.1

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	ENTRANCE/OFFICE LOCK	ND50BD SPA		626	SCH
1	EA	BEST SFIC CORE	1C-7		626	BES
			ALL OTHER EXISTING HARDWARE TO REMAIN			

Hardware Group No. 12

For use on Door #(s):
E160.1

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CLASSROOM SECURITY	ND75BD SPA		626	SCH
1	EA	BEST SFIC CORE	1C-7		626	BES
			ALL OTHER EXISTING HARDWARE TO REMAIN			

Hardware Group No. 13

For use on Door #(s):
E151.1 E148A.1

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	STOREROOM LOCK	ND80BD SPA		626	SCH
1	EA	BEST SFIC CORE	1C-7		626	BES
			ALL OTHER EXISTING HARDWARE TO REMAIN			

Hardware Group No. 14

For use on Door #(s):
150.1

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5		652	IVE
1	EA	PANIC HARDWARE	99-L-BE-17		626	VON
1	EA	SURFACE CLOSER	4040XP RW/PA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 15

For use on Door #(s):
E159.1

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	SURF. AUTO OPERATOR	9542 MS AS REQ (120/240 VAC)		628	LCN
2	EA	ACTUATOR, TOUCHLESS	8310-813		BLK	LCN

ALL OTHER EXISTING HARDWARE TO REMAIN

Hardware Group No. 16

For use on Door #(s):
E158.1

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	KEYED PRIVACY W/ OUTSIDE INDICATOR	ND50S SPA OS-OCC		626	SCH

ALL OTHER EXISTING HARDWARE TO REMAIN

NOTE: REMOVE EXISTING CLOSER

Hardware Group No. 17

For use on Door #(s):
108.1 113.1 128.1 206

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	CLASSROOM LOCK	ND70BD SPA		626	SCH
1	EA	BEST SFIC CORE	1C-7		626	BES
1	EA	WALL STOP	WS406/407CCV		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 18

For use on Door #(s):

114.1 127.1

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	CLASSROOM LOCK	ND70BD SPA		626	SCH
1	EA	BEST SFIC CORE	1C-7		626	BES
1	EA	OH STOP	90S		630	GLY
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 19

For use on Door #(s):

122.1 123.1

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50BD SPA		626	SCH
1	EA	BEST SFIC CORE	1C-7		626	BES
1	EA	WALL STOP	WS406/407CCV		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 20

For use on Door #(s):

119.2

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 5 X 4.5		652	IVE
1	EA	CLASSROOM LOCK	ND70BD SPA		626	SCH
1	EA	BEST SFIC CORE	1C-7		626	BES
1	EA	OH STOP	90S		630	GLY
1	EA	SURFACE CLOSER	4040XP REG		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 21

For use on Door #(s):
109.2

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	CLASSROOM LOCK	ND70BD SPA		626	SCH
1	EA	BEST SFIC CORE	1C-7		626	BES
1	EA	OH STOP	90S		630	GLY
1	EA	SURFACE CLOSER	4040XP REG		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 22

For use on Door #(s):
110.1

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	CLASSROOM LOCK	ND70BD SPA		626	SCH
1	EA	BEST SFIC CORE	1C-7		626	BES
1	EA	OH STOP	90S		630	GLY
1	EA	SURFACE CLOSER	4040XP EDA ST-2731 WMS		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 23

For use on Door #(s):
105.1

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	CLASSROOM LOCK	ND70BD SPA		626	SCH
1	EA	BEST SFIC CORE	1C-7		626	BES
1	EA	SURFACE CLOSER	4040XP RW/PA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	488SBK PSA		BLK	ZER

Hardware Group No. 24

For use on Door #(s):
106.1

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	CLASSROOM LOCK	ND70BD SPA		626	SCH
1	EA	BEST SFIC CORE	1C-7		626	BES
1	EA	OH STOP	90S		630	GLY
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 25

For use on Door #(s):
101.1 103.1

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5		652	IVE
1	EA	PUSH PLATE	8200 4" X 16"		630	IVE
1	EA	PULL PLATE	8303 10" 4" X 16"		630	IVE
1	EA	FOOT PULL	FP101		630	IVE
1	EA	SURF. AUTO OPERATOR	9542 MS AS REQ (120/240 VAC)		628	LCN
2	EA	ACTUATOR, TOUCHLESS	8310-813		BLK	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	488SBK PSA		BLK	ZER

ELECTRICAL OPERATION DESCRIPTION:
DOOR NORMALLY CLOSED. WAVING AT THE ACTUATOR ON EITHER SIDE OF DOOR WILL OPEN DOOR AUTOMATICALLY.

Hardware Group No. 26

For use on Door #(s):
147.1

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		612	IVE
1	EA	POWER TRANSFER	EPT10 CON		695	VON
1	EA	ELEC PANIC HARDWARE	LXRX-LC-QEL-99-L-NL-17-CON 24 VDC		612	VON
1	EA	SFIC RIM HOUSING	80-129		612	SCH
1	EA	BEST SFIC CORE	1C-7		612	BES
1	EA	OH STOP	90S		612	GLY
1	EA	SURFACE CLOSER	4040XP EDA ST-2731 WMS		690	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		612	IVE
1	EA	RAIN DRIP	142D		710	ZER
1	SET	GASKETING	429D-S		710	ZER
1	EA	DOOR SWEEP	8197D		710	ZER
1	EA	THRESHOLD	655D		719	ZER
2	EA	WIRE HARNESS (LENGTH AS REQUIRED)	CON-XX			SCH
1	EA	MULTI-TECH CARD READER	BY ACCESS CONTROL CONTRACTOR			
1	EA	DOOR POSITION SWITCH	679-05HM		BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS 120/240 VAC		GRY	VON
1	EA	ELEVATION DRAWING	BY HARDWARE SUPPLIER			
1	EA	POINT-TO-POINT WIRING DIAGRAM	BY ACCESS CONTROL INSTALLER			

ELECTRICAL OPERATION DESCRIPTION:
DOORS NORMALLY CLOSED AND LOCKED. DOORS MONITORED FOR POSITION (OPEN OR CLOSED) BY DOOR POSITION SWITCH. PUSH RAILS MONITORED FOR POSTION (INDICATING IF LATCHBOLTS ARE PROJECTED OR NOT) BY LX SWITCH IN EXIT DEVICE. PRESENTING VALID CREDENTIAL TO READER SHUNTS ALARM, MOMENTARILY RETRATCTS LATCHBOLTS .ALLOWING ENTRY. KEY OVER-RIDE ALSO ALLOWS UNDOCUMENTED ENTRY AND SENDS 'FORCED OPEN' NOTIFICATION TO THE MONITORING STATION. IN THE EVENT OF POWER LOSS DOOR REMAINS LOCKED. REQUEST-TO-EXIT (RX) SWITCH IN EXIT DEVICE SHUNTS ALARM WHEN EGRESSING.FREE EGRESS AT ALL TIMES.

Hardware Group No. 27

For use on Door #(s):
142.1

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	PIVOT SET	7212 SET		626	IVE
1	EA	LONG DOOR PULL	PR 9266 36" N		630	IVE
1	EA	OH STOP	90S		630	GLY
1	EA	SURFACE CLOSER	4040XP EDA ST-2731 WMS		689	LCN
3	EA	SILENCER	SR64		GRY	IVE

NOTE: PATCH FITTINGS FOR PIVOT SET BY GLASS DOOR MANUFACTURER

Hardware Group No. 28

For use on Door #(s):
104.1

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	PANIC HARDWARE	9947-L-DT-LBR-17		626	VON
1	EA	PANIC HARDWARE	9947-L-LBR-17		626	VON
1	EA	SFIC RIM HOUSING	80-129		626	SCH
1	EA	BEST SFIC CORE	1C-7		626	BES
2	EA	OH STOP	90S		630	GLY
2	EA	SURFACE CLOSER	4040XP EDA ST-2731 WMS		689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS		630	IVE
2	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 29

For use on Door #(s):
109.1 145.1 (fire rated hardware)

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		612	IVE
1	EA	PANIC HARDWARE	99-EO		612	VON
1	EA	OH STOP	90S		612	GLY
1	EA	SURFACE CLOSER	4040XP EDA ST-2731 WMS		690	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		612	IVE
1	EA	RAIN DRIP	142D		710	ZER
1	EA	SEALS	ALL SEALS BY ALUMINUM FRAME MANAFACTURER			
1	EA	DOOR SWEEP	8197D		710	ZER
1	EA	THRESHOLD	655D		719	ZER

Hardware Group No. 30

For use on Door #(s):

130.1

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
2	EA	MANUAL FLUSH BOLT	FB457		626	IVE
1	EA	DUST PROOF STRIKE	DP2		626	IVE
1	EA	CLASSROOM LOCK	ND70BD SPA		626	SCH
1	EA	BEST SFIC CORE	1C-7		626	BES
2	EA	OH STOP	90S		630	GLY
1	EA	SURFACE CLOSER	4040XP EDA ST-2731 WMS		689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS		630	IVE
2	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 31

For use on Door #(s):
134.1

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112HD EPT		710	IVE
1	EA	POWER TRANSFER	EPT10 CON		695	VON
1	EA	ELEC PANIC HARDWARE	LXRX-LC-QEL-33A-NL-OP-CON 24 VDC		710	VON
1	EA	SFIC RIM HOUSING	80-129		643E	SCH
1	EA	BEST SFIC CORE	1C-7		606	BES
1	EA	90 DEG OFFSET PULL	8190EZHD 10” O		716	IVE
1	EA	OH STOP	100S		695	GLY
1	EA	SURFACE CLOSER	4040XP EDA ST-2731 WMS		695	LCN
1	EA	RAIN DRIP	142D		710	ZER
1	EA	SEALS	ALL SEALS BY ALUMINUM FRAME MANAFACTURER			
1	EA	DOOR SWEEP	8197D		710	ZER
1	EA	THRESHOLD	655D		710	ZER
1	EA	WIRE HARNESS (LENGTH AS REQUIRED)	CON-XX			SCH
1	EA	MULTI-TECH CARD READER	BY ACCESS CONTROL CONTRACTOR			
1	EA	DOOR POSITION SWITCH	679-05HM		BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS 120/240 VAC			VON
1	EA	ELEVATION DRAWING	BY HARDWARE SUPPLIER			
1	EA	POINT-TO-POINT WIRING DIAGRAM	BY ACCESS CONTROL INSTALLER			

ELECTRICAL OPERATION DESCRIPTION:
DOORS NORMALLY CLOSED AND LOCKED. DOORS MONITORED FOR POSITION (OPEN OR CLOSED) BY DOOR POSITION SWITCH. PUSH RAILS MONITORED FOR POSTION (INDICATING IF LATCHBOLTS ARE PROJECTED OR NOT) BY LX SWITCH IN EXIT DEVICE. PRESENTING VALID CREDENTIAL TO READER SHUNTS ALARM, MOMENTARILY RETRATCTS LATCHBOLTS ALLOWING ENTRY. KEY OVER-RIDE ALSO ALLOWS UNDOCUMENTED ENTRY AND SENDS 'FORCED OPEN' NOTIFICATION TO THE MONITORING STATION. IN THE EVENT OF POWER LOSS DOOR REMAINS LOCKED. REQUEST-TO-EXIT (RX) SWITCH IN EXIT DEVICE SHUNTS ALARM WHEN EGRESSING.FREE EGRESS AT ALL TIMES.

Hardware Group No. 32

For use on Door #(s):

E200.1 E200.2

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	PANIC HARDWARE	1990-EO-HEX-SU	689	FAL
1	EA	PANIC HARDWARE	1993-NL-P-HEX-SU-CYL	689	FAL
1	EA	BEST SFIC CORE	1C-7	626	BES
1	EA	NOTE	ALL OTHER EXISTING HARDWARE TO REMAIN		

Hardware Group No. 33

For use on Door #(s):

110.2 154A.2

Provide each Folding Door with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CYLINDER	1E74-C4-RP3	626	BES

NOTE: ALL OTHER HARDWARE BY FOLDING PARTITION MANUFACTURER

Hardware Group No. 34

For use on Door #(s):

140.1 111.1

Provide each Roll-Up Door with the following:

ALL HARDWARE BY ROLL UP DOOR MANAFACTURER

Hardware Group No. 35

For use on Door #(s):

100.1 100.2 111.2 112.1 138.1

Provide each Sliding Door with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CYLINDER	1E74-C4-RP3	626	BES

NOTE: ALL OTHER HARDWARE BY SLIDING DOOR MANUFACTURER.

END OF SECTION

Door No	Hdw Set No.
100.1	35
100.2	35
101.1	25
102.1	09
103.1	25
104.1	28
105.1	23
106.1	24
108.1	17
109.1	29
109.2	21
110.1	22
110.2	33
111.1	35
111.2	35
112.1	35
113.1	17
114.1	18
119.1	03
119.2	20
121.1	02
122.1	19
123.1	19
124.1	09
125.1	09
126.1	09
127.1	18
128.1	17
130.1	30
134.1	31
138.1	35
138A.1	08
140	34
142.1	27
143.1	01
145.1	29
146.1	07
147	06
147.1	26
150.1	14
154.1	05
154A.1	04
154A.2	33
162.1	03
174.1	02
206	17

Door No	Hdw Set No.
E148A.1	13
E150.1	10
E151.1	13
E152.1	10
E158.1	16
E160.1	12
E159.1	15
E160.1	10
E161.1	10
E162.1	10
E162.2	10
E163.1	10
E166.1	11
E169.1	10
E170.1	10
E171.1	10
E172.1	10
E200.1	32
E200.2	32
E202A.1	10
E203.1	11
E203A.1	10
E265.1	10

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SECTION 08 80 00
GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Insulating glass units.

B. Glazing units.

C. Glazing compounds and accessories.

1.02 RELATED REQUIREMENTS

A. Section 06 41 00 - Architectural Wood Casework: Cabinets with requirements for glass shelves.

B. Section 07 25 00 - Weather Barriers.

C. Section 07 92 00 - Joint Sealants: Sealants for other than glazing purposes.

D. Section 08 11 13 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.

E. Section 08 14 16 - Flush Wood Doors: Glazed lites in doors.

F. Section 08 14 33 - Stile and Rail Wood Doors: Glazed lites in doors.

G. Section 08 42 29 - Automatic Entrances: Glazing furnished as part of door assembly.

H. Section 08 43 13 - Aluminum-Framed Storefronts: Glazing furnished as part of storefront assembly.

I. Section 08 44 13 - Glazed Aluminum Curtain Walls: Glazing furnished as part of wall assembly.

J. Section 08 83 00 - Mirrors.

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.

B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015.

C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

D. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2019).

E. ASTM C1036 - Standard Specification for Flat Glass; 2016.

F. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.

G. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2015.

H. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2016.

I. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2010.

J. GANA (SM) - GANA Sealant Manual; 2008.

K. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2017.

L. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2014, with Errata (2017).

M. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2017.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by each of the affected installers.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data on Insulating Glass Unit and Glazing Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.

D. Samples: Submit two samples 12 by 12 inch in size, showing coloration and design.
   1. Insulating glass

E. Certificate: Certify that products of this section meet or exceed specified requirements.

F. Manufacturer's Qualification Statement.

G. Installer's Qualification Statement.

H. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner / Library's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years documented experience.

1.07 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 40 degrees F.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Insulating Glass Units: Provide a ten (10) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Float Glass Manufacturers:
   1. AGC Glass North America, Inc: www.agcglass.com/#sle.
   2. Cardinal Glass Industries: www.cardinalcorp.com/#sle.
   3. Guardian Glass, LLC: www.guardianglass.com/#sle.
   4. Pilkington North America Inc: www.pilkington.com/na/#sle.
   5. Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com/#sle.
   6. Or Approved equal.

B. Insulated Metal Panel Manufacturers:
   1. Mapes Industries, Inc.
   2. Or Approved Equal

2.02 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of

glass.
1. Design Pressure: Calculated in accordance with ASCE 7.
2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
3. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
4. Glass thicknesses listed are minimum.

B. Vapor Retarder and Air Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure vapor retarder and air barrier.
1. In conjunction with vapor retarder and joint sealer materials described in other sections.
a. Refer to Section 07 25 00.

C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
3. Solar Optical Properties: Comply with NFRC 300 test method.

2.03 GLASS MATERIALS

A. Float Glass: Provide float glass based glazing unless otherwise indicated.
1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3.
2. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.
3. Tinted Type: ASTM C1036, Class 2 - Tinted, Quality - Q3, with color and performance characteristics as indicated.

2.04 INSULATING GLASS UNITS

A. Manufacturers:
1. Any of the manufacturers specified for float glass.
2. Fabricator certified by glass manufacturer for type of glass, coating, and treatment involved and capable of providing specified warranty.

B. Insulating Glass Units: Types as indicated.
1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
3. Metal Edge Spacers: Aluminum, bent and soldered corners.
4. Spacer Color: Aluminum.
5. Edge Seal:
a. Color: Black.
6. Purge interpane space with dry air, hermetically sealed.

C. Type IG - Insulating Glass Units: Vision glass, double glazed.
1. Basis of Design: Vitro Architectural Glass; Solarban 70 XL (2) Solarbronze + Clear Glass
2. Applications: Exterior glazing unless otherwise indicated.
3. Space between lites filled with argon.
4. Outboard Lite: Annealed float glass, 1/4 inch thick, minimum.
a. Tint: Bronze.
b. Coating: Low-E (passive type), on #2 surface.
5. Inboard Lite: Annealed float glass, 1/4 inch thick, minimum.
a. Tint: Clear.
6. Total Thickness: 1 inch.

7. Thermal Transmittance (U-Value), Winter - Center of Glass: 0.24, nominal.
8. Visible Light Transmittance (VLT): 42 percent, nominal.
9. Solar Heat Gain Coefficient (SHGC): 0.32, nominal.
10. Visible Light Reflectance, Outside: 7 percent, nominal.

D. Type ISG Insulating Glass Units: Safety Glazing.
1. Basis of Design: Vitro Architectural Glass; Solarban 70 XL (2) Solarbronze + Clear Glass
2. Applications: Exterior glazing unless otherwise indicated
   a. Glazed lites in exterior doors.
   b. Glazed sidelights and panels next to doors.
   c. Other locations required by applicable federal, state, and local codes and regulations.
   d. Other locations indicated on drawings.
3. Outboard Lite: Fully tempered float glass, 1/4 inch thick , minimum.
   a. Tint: Bronze
   b. Coating: Low-E (passive type), on #2 surface.
4. Inboard Lite: Fully tempered float glass, 1/4 inch thick, , minimum.
   a. Tint: Clear
5. Total Thickness: 1 inch
6. Thermal Transmittance (U-Value) , Winter - Center of Glass 0.24, , nominal.
7. Visible Light Transmittance (VLT): 42 percent, , nominal.
8. Solar Heat Gain Coefficient (SHGC): 0.32, , nominal
9. Visible Light Reflectance: 7 percent, , nominal

2.05 GLAZING UNITS

A. Type FG - Monolithic Interior Vision Glazing:
1. Applications: Interior glazing unless otherwise indicated.
2. Glass Type: Annealed float glass.
3. Tint: Clear.
4. Thickness: 1/4 inch, nominal.

B. Type SG - Monolithic Safety Glazing: Non-fire-rated.
1. Applications:
   a. Glazed lites in doors, except fire doors.
   b. Glazed sidelights to doors, except in fire-rated walls and partitions.
   c. Other locations required by applicable federal, state, and local codes and regulations.
   d. Other locations indicated on drawings.
2. Glass Type: Fully tempered safety glass as specified.
3. Tint: Clear.
4. Thickness: 1/4 inch, nominal.

2.06 ACCESSORIES

A. Setting Blocks: EPDM, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch by width of glazing rabbet space minus 1/16 inch by height to suit glazing method and pane weight and area.

B. Spacer Shims: EPDM, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch long by one half the height of the glazing stop by thickness to suit application, self adhesive on one face.

C. Glazing Gaskets: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.

D. Glazing Clips: Manufacturer's standard type.

E. Sealant: As recommended by manufacturer.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.

B. Verify that the minimum required face and edge clearances are being provided.

C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

D. Verify that sealing between joints of glass framing members has been completed effectively.

E. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.

B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.

C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.

D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.

E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.

F. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, etc.

3.04 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.

B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.05 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.

C. Monitor and report installation procedures and unacceptable conditions.

3.06 CLEANING

A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.

B. Remove non-permanent labels or films immediately after glazing installation is complete.

C. Clean glass and adjacent surfaces after sealants are fully cured.

D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.07 PROTECTION

A. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION

SECTION 08 83 00
MIRRORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glass mirrors.

1.02 RELATED REQUIREMENTS

A. Section 10 28 00 - Toilet and Bath Accessories: Metal mirror frames.

1.03 REFERENCE STANDARDS

A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes;2014.

B. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.

C. ASTM C1036 - Standard Specification for Flat Glass; 2016.

D. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2018.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data on Mirror Types: Submit structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

C. Samples: Submit two samples, 12 x 12 inch in size, illustrating mirrors edging and coloration.

D. Manufacturer's Certificate: Certify that mirrors, meets or exceeds specified requirements.

E. Maintenance Materials: Furnish the following for Owner / Library's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.

1.05 QUALITY ASSURANCE

A. Fabricate, store, transport, receive, install, and clean mirrors in accordance with manufacturer's recommendations.

1.06 FIELD CONDITIONS

A. Do not install mirrors when ambient temperature is less than 50 degrees F.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for reflective coating on mirrors and replacement of same.

PART 2 PRODUCTS

2.01 MATERIALS

A. Mirror Design Criteria: Select materials and/or provide supports as required to limit mirror material deflection to 1/200, or to the flexure limit of glass, with full recovery of glazing materials, whichever is less.

B. Mirror Glass: ASTM C1036, Type 1 - Transparent Flat, Class 1 - Clear, Quality - Q1 (high-quality mirrors); silvering, protective coating, and quality requirements in compliance with ASTM C1503.
   1. Thickness: 1/4 inch.
   2. Size: As indicated on drawings.

2.02 ACCESSORIES

A. Setting Blocks: Neoprene, 80 to 90 Shore A durometer hardness.

B. Mirror Adhesive: Silicone pre-polymer based, chemically compatible with mirror coating and wall substrate.

C. J-Shape **Bottom and Top Trim**: Aluminum extrusion, 3/8 inch by 7/8 inch by 1/4 inch deep.
   1. Material: Comply with ASTM B221 (ASTM B221M), 6005-T6 alloy and temper.
   2. Finish: Anodized, clear.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that openings for mirrored glazing are correctly sized and within tolerance.

B. Verify that surfaces of mirror frames or recesses are clean, free of obstructions, and ready for installation of mirrors.

3.02 PREPARATION

A. Clean contact surfaces with solvent and wipe dry.

3.03 INSTALLATION

A. Install mirrors in accordance with manufacturer's recommendations.

B. Set mirrors plumb and level, and free of optical distortion.

C. Set mirrors with edge clearance free of surrounding construction including countertops or backsplashes.

D. 'Frameless' Mirrors: Set mirrors in proper place with adhesive after installing j-trim channel, applied in accordance with adhesive manufacturer's instructions.

3.04 CLEANING

A. Remove wet glazing materials from finish surfaces.

B. Remove labels after work is complete.

C. Clean mirrors and adjacent surfaces.

END OF SECTION

SECTION 09 0000 – FINISH AND MATERIALS LEGEND

Swatch	Tag	Manufacturer	Product Description	Location(s)
DIVISION 6 – WOOD, PLASTICS, AND COMPOSITES				
06 20 00 Finish Carpentry				
	WD-1	Masonite Architectural (as basis of design for stain)	Species: Natural Birch Stain color: Nutmeg	Casings and baseboard throughout unless noted otherwise
06 41 00 Architectural Wood Casework (and PLAM)				
	WD-1	Masonite Architectural (as basis of design for stain)	Species: Natural Birch Stain color: Nutmeg	Circulation desk, Curved casework at Circulation 116 (south of circ desk), Shelving at Fireplace 137
	WD-2	Masonite Architectural (as basis of design for stain)	Species: White Maple Stain color: Nutmeg	Casework in Children's 134 and Discover Zone 135
	PLAM-1	Formica	Color: Oiled Legno 8846 Finish: Matte 58	Casework in Kitchen 107, Meeting Room 109, Storytime 110, Canteen 156
	PLAM-2	Pionite	Color: Head Over Heels AB300-SD Finish: Textured/ Suede	Casework in staff areas – Staff Workroom 119, Kitchen 120, Tech Services 154, Staff Breakroom 172, Youth Storage 174
	PLAM-3	Wilsonart	Color: Carbon Mesh 4880 Finish: Matte 60	Casework in Makerspace 138
DIVISION 8 – OPENINGS				
08 14 16 Flush Wood Doors				
	WD-1	Masonite Architectural (as basis of design for stain)	Species: Natural Birch Stain color: Nutmeg	Wood doors

DIVISION 9 – FINISHES				
09 30 00 Tiling				
	CT-1	MILE®stone	Style: Urban Living Color: Pearl Matte Size: 12” x 24” Installation: Ashlar	Floors in Men’s 101, Family 102, Women’s 103, Staff RR 125, Toilet 126, Toilet 158, and Toilet 159
	CT-2	MILE®stone	Style: Urban Living Color: Pearl Matte Size: 6” x 12” Cove Base	Wall base in Men’s 101, Family 102, Women’s 103, Staff RR 125, Toilet 126, Toilet 158, and Toilet 159
	CT-3	MILE®stone	Style: Urban Living Color: Nimbus Glossy Size: 3” x 12” Installation: 1/3 Offset	Fixture walls in Men’s 101, Family 102, Women’s 103, Staff RR 125, Toilet 126, Toilet 158, and Toilet 159 per interior elevations
	CT-4	MILE®stone	Style: Urban Living Color: Pure Glossy Size: 3” x 12” Installation: 1/3 Offset	Fixture walls in Men’s 101, Family 102, Women’s 103, Staff RR 125, Toilet 126, Toilet 158, and Toilet 159 per interior elevations
	GT-1	CUSTOM Building Products	Color: Delorean Gray #165 Thickness: 3/16”	Used with CT-1. CT-2, CT-3, and CT-4
09 51 13 Acoustical Panel Ceilings				
	ACT-1	USG	Style: Mars Pattern: Fine Texture Edge: Tegular Size: 24” x 24” Color: White	General
	ACT-2	USG	Style: Mars Healthcare Pattern: Fine Texture Edge: Square Size: 24” x 24” Color: White	Restrooms
09 54 26 Suspended Wood Ceilings				
	WG-1	Armstrong Ceilings	StyleL Woodworks Grille Color: Light Cherry Slat Size: 5/8”W x 3-1/4”H (5 slats per panel) Space between slats: 1-3/4”	Lobby

09 65 13 Resilient Base & Accessories				
	RB-1	Tarkett	Johnsonite 4” base Color: Burnt Umber 63	Vestibules, Children’s, Staff Areas, Storage rooms, IT closet, Makerspace, Friends, Canteen Toe kick at casework throughout

09 65 19 Resilient Tile				
	LVT-1	Mannington Commercial	Collection: Color Anchor Style: Stride Color: Misty Mountain (C161) Size: 6” x 36” Installation: Herringbone (random)	**Canteen 156, Staff Breakroom 172, Kitchen 120** – random herringbone pattern in equal parts LVT-1 (TBD) and LVT-2A (TBD)
	LVT-2A	Mannington Commercial	Collection: Color Anchor Style: Stride Color: London Fog C139 Size: 6” x 36” Installation: Herringbone (random)	**Canteen 156, Staff Breakroom 172, Kitchen 120** – random herringbone pattern in equal parts LVT-1 (TBD) and LVT-2A (TBD)
	LVT-2B	Mannington Commercial	Collection: Color Anchor Style: Stride Color: London Fog C139 Size: 6” x 36” Installation: Random Stagger	Kitchen Storage 106, Kitchen 107, Storage 108
	LVT-3	Mannington Commercial	Collection: Color Anchor Style: Stride Color: Big Wave C170 Size: 18” x 18” Installation: Monolithic (random)	**Storytime 110 at Casework, Youth Storage** – random monolithic pattern in equal parts LVT-3 (Big Wave), LVT-4 (Squash Blossom), LVT-5 (Milk Thistle), and LVT-6 (Granny Smith)
	LVT-4	Mannington Commercial	Collection: Color Anchor Style: Stride Color: Squash Blossom C132 Size: 18” x 18” Installation: Monolithic (random)	**Storytime 110 at Casework, Youth Storage** – random monolithic pattern in equal parts LVT-3 (Big Wave), LVT-4 (Squash Blossom), LVT-5 (Milk Thistle), and LVT-6 (Granny Smith)
	LVT-5	Mannington Commercial	Collection: Color Anchor Style: Stride Color: Milk Thistle C121 Size: 18” x 18” Installation: Monolithic (random)	**Storytime 110 at Casework, Youth Storage** – random monolithic pattern in equal parts LVT-3 (Big Wave), LVT-4 (Squash Blossom), LVT-5 (Milk Thistle), and LVT-6 (Granny Smith)

	LVT-6	Mannington Commercial	Collection: Color Anchor Style: Stride Color: Granny Smith C175 Size: 18” x 18” Installation: Monolithic (random)	**Storytime 110 at Casework, Youth Storage** – random monolithic pattern in equal parts LVT-3 (Big Wave), LVT-4 (Squash Blossom), LVT-5 (Milk Thistle), and LVT-6 (Granny Smith)
09 68 13 Tile Carpet				
	WCPT-1	J+J Flooring	Style: Catwalk II 7268 Color: 1427 Spotlight Size: 24” x 24” Installation: Monolithic	Vestibules 100 and 112
	CPT-1	Tarkett	Style: Celestial 11688 Color: Grey Screen 14304 Size: 24” x 24” Installation: Ashlar	**General** – circulation carpet in Adult and Children’s Study Rooms 113, 114, 127, 128; IT Closet 130; Elevator Accent carpet in Adult collections
	CPT-2	Tarkett	Style: Celestial 11688 Color: Salsa Verde 14308 Size: 24” x 24” Installation: Ashlar (random)	**Fiction Adult** – random ashlar pattern in 75% CPT-2 (Salsa Verde) and 25% CPT-1 (Grey Screen)
	CPT-3	Tarkett	Style: Celestial 11688 Color: Violaceous 14311 Size: 24” x 24” Installation: Ashlar (random)	**Nonfiction Adult** – random ashlar pattern in 75% CPT-3 (Violaceous) and 25% CPT-1 (Grey Screen)
	CPT-4	Tarkett	Style: Celestial 11688 Color: Blue Saturn 14307 Size: 24” x 24” Installation: Ashlar (random)	**Public Computers** – random ashlar pattern in 75% CPT-4 (Blue Saturn) and 25% CPT-1 (Grey Screen)
	CPT-5	Tarkett	Style: Celestial 11688 Color: Flotilla 14309 Size: 24” x 24” Installation: Ashlar	Fireplace
	CPT-6	Tarkett	Style: Celestial 11688 Color: Lakeside 14310 Size: 24” x 24” Installation: Ashlar (random)	**Teen** – random ashlar pattern in 75% CPT-6 (Lakeside) and 25% CPT-7 (Muddy Waters)
	CPT-7	Tarkett	Style: Celestial 11688 Color: Muddy Waters 14305 Size: 24” x 24” Installation: Ashlar (random)	**Teen** – random ashlar pattern in 75% CPT-6 (Lakeside) and 25% CPT-7 (Muddy Waters)

	CPT-8	Shaw Contract	Style: Saturate Tile 5T109 Color: Silver 07518 Size: 9” x 36” Installation: Herringbone	**Discover Zone** - herringbone pattern in equal parts CPT-9 (Citron), CPT-10 (Chartreuse), and CPT-8 (Silver) **Children Collection** - herringbone pattern in equal parts CPT-11 (Cornflower), CPT-12 (Aqua), and CPT-8 (silver)
	CPT-9	Shaw Contract	Style: Saturate Tile 5T109 Color: Citron 07225 Size: 9” x 36” Installation: Herringbone	**Discover Zone** - herringbone pattern in equal parts CPT-9 (Citron), CPT-10 (Chartreuse), and CPT-8 (Silver)
	CPT-10	Shaw Contract	Style: Saturate Tile 5T109 Color: Chartreuse 07325 Size: 9” x 36” Installation: Herringbone	**Discover Zone** - herringbone pattern in equal parts CPT-9 (Citron), CPT-10 (Chartreuse), and CPT-8 (Silver)
	CPT-11	Shaw Contract	Style: Saturate Tile 5T109 Color: Orange 07669 Size: 9” x 36” Installation: Herringbone	**Children Collection** - herringbone pattern in equal parts CPT-11 (Orange), CPT-12 (Aqua), and CPT-8 (silver)
	CPT-12	Shaw Contract	Style: Saturate Tile 5T109 Color: Aqua 07327 Size: 9” x 36” Installation: Herringbone	**Children Collection** - herringbone pattern in equal parts CPT-11 (Orange), CPT-12 (Aqua), and CPT-8 (silver)
	CPT-13	J+J Flooring	Style: Naturalist Modular 7572 Color: Sky 3228 Size: 24” x 24” Installation: Monolithic	Staff Areas, Upper level of Existing
09 68 16 Sheet Carpet				
	CPT-14	Tarkett	Style: Celestial 11688 Color: Grey Screen 14304 Size: 72”W	Stairs throughout
09 72 00 Vinyl Wallcovering				
	VWC-1	Gravity Digital Walls	Style: Hudson Color: Cool Vibes TWV-C-IL	South wall of Canteen 156

09 72 60 Tackable Wallcovering				
	TWC-1	Forbo	Style: Bulletin Board Color: Tangerine Zest #2211	South wall of Makerspace 138 per elevations
	TWC-2	Forbo	Style: Bulletin Board Color: Baby Lettuce #2213	South wall of Makerspace 138 per elevations
	TWC-3	Forbo	Style: Bulletin Board Color: Blue Berry #2214	South wall of Makerspace 138 per elevations

09 84 30 Sound Absorbing Ceiling Units				
	ACU-1A	MDC Wall	Style: Zintra Color: Sky Size: 24”, Small Triangle	Youth Circulation 131 per reflected ceiling plans
	ACU-1B	MDC Wall	Style: Zintra Color: Sky Size: 48”, Large Triangle	Youth Circulation 131 per reflected ceiling plans
	ACU-2A	MDC Wall	Style: Zintra Color: Sunshine Size: 24”, Small Triangle	Youth Circulation 131 per reflected ceiling plans
	ACU-2B	MDC Wall	Style: Zintra Color: Sunshine Size: 48”, Large Triangle	Youth Circulation 131 per reflected ceiling plans
	ACU-3A	MDC Wall	Style: Zintra Color: Grass Size: 24”, Small Triangle	Youth Circulation 131 per reflected ceiling plans
	ACU-3B	MDC Wall	Style: Zintra Color: Grass Size: 48”, Large Triangle	Youth Circulation 131 per reflected ceiling plans
	ACU-4	MDC Wall	Style: Zintra, Turbine Color: TBD Size: 48.93” dia. x 15.5”H	Clerestory in Lobby 111, Circulation 116, and Circulation 141 per reflected ceiling plans

09 91 23 Interior Paint				
	P-1	Sherwin Williams	Color: SW7005 Pure White	Gyp. board ceilings unless otherwise noted
	P-2	Sherwin Williams	Color: SW7647 Crushed Ice	General paint Interior HM doors

	P-3	Sherwin Williams	Color: SW9032 Stay in Lime	Accent paint – South wall of Study 113
	P-4	Sherwin Williams	Color: SW6839 Kimono Violet	Accent paint – North wall of Study 114, North wall of Makerspace 138, East wall of Makerspace 138 (only at Storage 139)
	P-5	Sherwin Williams	Color: SW6663 Saffron Thread	Accent paint – South wall of Study 127, Soffit at Circ Desk
	P-6	Sherwin Williams	Color: SW6488 Grand Canal	Accent paint – South wall of Study 128, North wall of Public Computers 145
	P-7	Sherwin Williams	Color: SW9030 Limon Fresco	Accent paint – North wall of Children's (see elevation) Ceilings – 8'-6" A.F.F. ceiling in Storytime 110
	P-8	Sherwin Williams	Color: SW6530 Reveal Blue	Accent paint – North and east walls of Children's (see elevations) Ceilings – North 9'-6" A.F.F. ceiling in Meeting Room 109, 10'-0" A.F.F. ceiling in Storytime 110
	P-9	Sherwin Williams	Color: SW6641 Outgoing Orange	Accent paint – North wall of Children's (see elevation) Ceilings – South 9'-6" A.F.F. ceiling in Meeting Room 109
	P-10	Sherwin Williams	Color: SW9043 Aquastone	Accent paint – South and north walls of Children's (see elevations) Ceilings – 8'-6" A.F.F. ceiling in Meeting Room 109
	P-11	Sherwin Williams	Color: SW6185 Escape Gray	Accent paint – West wall of Librarian 122
	P-12	Sherwin Williams	Color: SW6542 Vesper Violet	Accent paint – West wall of Director 121
	P-13	Sherwin Williams	Color: SW9021 Naples Yellow	Accent paint – West wall of Assist. Dir. 123, North wall of Staff Breakroom 172
	P-14	Sherwin Williams	Color: SW9138 Stardew	Accent paint – West wall of Kitchen 120, Toilets (as noted on finish plan)

	P-15	Sherwin Williams	Color: SW7605 Gale Force	Accent paint – Curved wall at Circulation 116 & 131 (below wood trim) Northwest wall, West wall, and Southwest wall of Vestibule 100
DIVISION 10 – SPECIALTIES				
10 11 00 Visual Display Units				
	MB-1	Calyx by Claridge (as basis of design)	Style: Connect X2 Wall-Mounted Whiteboards Surface: Glass Color: Brilliant White Size: 72”W x 48”H Options: No reveal Accessories: Magnetic marker tray/caddy	South wall of Study 113, North wall of Study 114, East walls of Study 127 and Study 128
	MB-2	Calyx by Claridge (as basis of design)	Style: Connect X2 Wall-Mounted Whiteboards Surface: Glass Color: Brilliant White Size: 48”W x 48”H Options: No reveal Accessories: Magnetic marker tray/caddy	North wall of Director 121, South wall of Librarian 122, and North wall of Assist. Dir. 123, East wall of Staff Workroom 119
	TB-1	Calyx by Claridge	Style: Connect X2 Tack Surfaces Surface: Cork Color: Steel Grey #1113 Size: 48”W x 48”H Options: No reveal	East wall of Staff Workroom 119, South wall of Canteen 156
10 12 00 Display Cases				
	DC-1	ASI (as basis of design)	Style: Bulletin Directory Configuration: Sliding glass doors, lockable Size: 72”W x 48”H Surface: Forbo, Duck Egg #2162	Display cases on north wall of Lobby 111 (outside Makerspace)
10 14 00 Signage				
	PS	ASI Signage (as basis of design)	Panel sign color: Lead SC-914 Text color: Ivory MX01	Panel signage throughout (see A6 Signage sheet for details, A9 sheets for locations, and signage schedule in specs)

	VL		Text color: TBD (verify in shop drawings) Text size: (varies; verify in shop drawings)	Vinyl letter signage throughout (see A6 Signage sheet for details, A9 sheets for locations, and signage schedule in specs)
	DL		Finish: TBD (verify in shop drawings) Letter size: (varies; verify in shop drawings)	Dimensional metal letter signage throughout (see A6 Signage sheet for details, A9 sheets for locations, and signage schedule in specs)
10 21 13 Toilet Compartments				
	TPT-1	Scranton	Style: Hiny Hiders Color: Stainless Hammered (tested in accordance with NFPA 286)	Toilet partitions
10 26 00 Wall Protection				
	RWC-1	Inpro (as basis of design)	Style: Inpro Color: Gala 0380	Wall protection at hand dryers in Gender Neutral Toilet 158, Toilet 159, Men's 101, Family 102, Women's 103 Interior finish of Discover Zone entry
	CG-1	Inpro (as basis of design)	Style: 160 High Impact Corner Guard (2") Color: Gala 0380	General
10 22 39 Folding Panel Partition				
		Modernfold	Vinyl panel Style: Len-Tex, TBD Color: TBD	
10 51 13 Metal Lockers				
	LCK-1	ASI (as basis of design)	Style: Traditional, single tier Size: 12"W x 15"D x 60"H Color: Gray #25 Quantity: 15 Lock type: Hasp Accessories: 4" Zee base, slope hood	Staff Workroom 119

DIVISION 12 - FURNISHINGS				
12 24 00 Window Shades				
	WS-1	Draper Inc.	Type: Sheerweave by Phifer Style: 2360 Color: Oyster/Pearl Grey P14 Openness: 10%	Solar shades per window shade schedule
	WS-2	Draper Inc.	Type: Sheerweave by Phifer Style: 2500 Color: Oyster/Pearl Grey P14 Openness: 1%	Solar shades per window shade schedule
	WS-3	Draper Inc.	Type: Sheerweave by Phifer Style: SW7500 Color: Limestone R41 Openness: Blackout	Blackout shades per window shade schedule
12 36 61 Countertops				
	SS-1	Corian	Color: Limestone Prima	Countertops at Circulation Desk and casework in Kitchen 107, Storytime 110, Canteen 156 Windowsills
	SS-2	Wilsonart	Color: Flint Rock 9207CS	Countertops in Makerspace 138
	SS-3	Corian	Color: Everest	Countertop at sinks in Kitchen 120 (Circ), Tech Services 154, and Staff Breakroom 172
	PLAM-5	Wilsonart	Color: Shadow Zephyr 4857 Finish: Matte 60	Countertop at casework in Meeting Room 109 Laptop bar countertop in Teen Collection 142 Countertop at mailboxes and worktables in Staff Workroom 119 (Circ), Tech Services 154, and Storage 174
12 64 00 Upholstered Assemblies				
	UA-1	CF Stinson	Style: Cassidy 2.0 Color: Maize CAS277 Size: 24”D (to fit curved bench and reading nooks)	Bench/back cushion at curved seating and seat cushions at reading nooks in Discover Zone 135

	UA-2	Designtex	Style: Beguiled by the Wild 3043 Color: Tamarin 704 Size: approximately 72”W x 24”D	Bench cushion at casework in Children’s 134 (east elevation)
	UA-3	CF Stinson	Style: Cassidy 2.0 Color: Maize CAS277 Size: approximately 34”W x 42”D	Study carrels play mats in Youth Comp. 133

END OF SECTION 090000

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SECTION 09 21 16
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.

B. Gypsum sheathing.

C. Cementitious backing board.

D. Gypsum wallboard.

E. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS

A. Section 05 40 00 - Cold-Formed Metal Framing: Structural steel stud framing.

B. Section 06 10 00 - Rough Carpentry: Wood blocking product and execution requirements.

C. Section 07 21 00 - Thermal Insulation: Acoustic insulation.

D. Section 07 84 00 - Firestopping: Top-of-wall assemblies at fire-resistance-rated walls.

E. Section 07 92 00 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

F. Section 09 22 16 - Non-Structural Metal Framing.

G. Section 09 30 00 - Tiling: Tile backing board.

1.03 REFERENCE STANDARDS

A. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2018.

B. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 1999 (Reaffirmed 2016).

C. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017.

D. ASTM C514 - Standard Specification for Nails for the Application of Gypsum Board; 2004 (Reapproved 2020).

E. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2019b.

F. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2018.

G. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2018.

H. ASTM C1047 - Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base; 2019.

I. ASTM C1325 - Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units; 2019.

J. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.

K. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels; 2019.

L. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2016.

M. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).

N. ASTM E413 - Classification for Rating Sound Insulation; 2016.

O. GA-216 - Application and Finishing of Gypsum Panel Products; 2016.

P. GA-600 - Fire Resistance Design Manual; 2015.

Q. UL (FRD) - Fire Resistance Directory; Current Edition.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on gypsum board, glass mat faced gypsum board, accessories, and joint finishing system.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.

B. Interior Partitions, Indicated as Acoustic: Provide completed assemblies with the following characteristics:
   1. Acoustic Attenuation: STC of 55-59 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

C. Fire-Resistance-Rated Assemblies: Provide completed assemblies with the following characteristics:
   1. Fire-Resistance-Rated Partitions: UL listed assembly No. As indicated on wall types; 1 hour rating.
   2. Fire-Resistance-Rated Shaft Walls: UL listed assembly No. V473; 1 hour rating.
   3. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD).

2.02 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
   1. American Gypsum Company: www.americangypsum.com/#sle.
   2. CertainTeed Corporation: www.certainteed.com/#sle.
   3. Continental Building Products: www.continental-bp.com/#sle.
   4. Georgia-Pacific Gypsum: www.gpgypsum.com/#sle.
   5. National Gypsum Company: www.nationalgypsum.com/#sle.
   6. USG Corporation: www.usg.com/#sle.
   7. Or approved equal.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
      a. Mold resistant board is required at the following locations.
         1) Janitor
         2) Utility
         3) Interior face of Archive perimeter walls.
   3. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
   4. Thickness:
      a. Vertical Surfaces: 5/8 inch.
      b. Ceilings: 5/8 inch.
      c. Shaft Liner: 1 inch.

C. Impact Resistant Wallboard:
   1. Application: in Discovery Zone walls and all Vestibule walls.

2. Surface Abrasion: Level 3, minimum, when tested in accordance with ASTM C1629/C1629M.
3. Indentation: Level 1, minimum, when tested in accordance with ASTM C1629/C1629M.
4. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
5. Type: Fire-resistance-rated Type X, UL or WH listed.
6. Thickness: 5/8 inch.
7. Edges: Tapered.
8. Paper-Faced Products:
   a. American Gypsum Company; M-Bloc IR Type X.
   b. CertainTeed Corporation; Extreme Impact Resistant Drywall with M2Tech.
   c. National Gypsum Company; Gold Bond Hi-Impact XP Gypsum Board.
   d. USG Corporation; USG Sheetrock Brand Mold Tough VHI Firecode X Panels: www.usg.com/#sle.
   e. Or approved equal.

D. Backing Board For Wet Areas:
1. Application: Surfaces behind tile in wet areas including restroom walls and demonstration kitchen.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
3. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C1325.
   a. Thickness: 1/2 inch.
   b. Products:
      1) National Gypsum Company; PermaBase Cement Board: www.nationalgypsum.com/#sle.
      2) USG Corporation: www.usg.com/#sle.

E. Shaftwall and Coreboard: Type X; 1 inch thick by 24 inches wide, beveled long edges, ends square cut.
1. Paper-Faced Type: Gypsum shaftliner board or gypsum coreboard as defined ASTM C1396/C1396M; water-resistant faces.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
3. Paper-Faced Products:
   a. American Gypsum Company; M-Bloc Shaft Liner.
   b. CertainTeed Corporation; M2Tech Type X Shaftliner.
   c. Georgia-Pacific Gypsum; ToughRock Shaftliner.
   d. National Gypsum Company; Gold Bond Fire-Shield Shaftliner XP.
   e. Or Approved Equal.

2.03 GYPSUM WALLBOARD ACCESSORIES

A. Acoustic Insulation: As specified in Section 07 21 00.

B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
1. Products:
   a. Franklin International, Inc; Titebond GREENchoice Professional Acoustical Smoke and Sound Sealant: www.titebond.com/#sle.
   b. Grabber Construction Products; Acoustic Sealant GSC
   c. Liquid Nails, a brand of PPG Architectural Coatings; AS-825 Acoustical Sound Sealant: www.liquidnails.com/#sle.
   d. Pecora Corporation; AIS-919
   e. Specified Technologies Inc; Smoke N Sound Acoustical Sealant: www.stifirestop.com/#sle.
   f. USG Corporation: SHEETROCK Acoustical Sealant
   g. Or approved equal.

C. Finishing Accessories: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.
   1. Types: As detailed or required for finished appearance.
   2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead at exposed panel edges.

D. Beads, Joint Accessories, and Other Trim: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.
   1. Corner Beads: Low profile, for 90 degree outside corners.
   2. L-Trim with Tear-Away Strip: Sized to fit 5/8 inch thick gypsum wallboard.
   3. Expansion Joints:
      a. Type: V-shaped metal with factory-installed protective tape.

E. Decorative Metal Trim:
   1. Material: Extruded aluminum alloy 6063-T5 temper.
   2. Finish: White.
   3. Type: Profile as selected from manufacturer's standard range.
   4. Edge Trim at Exposed Gyspum Board Ceiling Elements:
      a. USGCompasso

F. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
   1. Fiberglass Tape: 2 inch wide, coated glass fiber tape for joints and corners, except as otherwise indicated.
   2. Paper Tape: 2 inch wide, creased paper tape for joints and corners, except as otherwise indicated.
   3. Joint Compound: Drying type, vinyl-based, ready-mixed.
   4. Joint Compound: Setting type, field-mixed.

G. Finishing Compound: Surface coat and primer, takes the place of skim coating.

H. High Build Drywall Surfacer: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.
   1. Products:
      a. CertainTeed Corporation; Level V Wall and Ceiling Primer/Surfacer with M2Tech: www.certainteed.com/#sle.
      b. USG Corporation; USG Sheetrock Brand Tuff-Hide Primer-Surfacer: www.usg.com/#sle.
      c. Or approved equal.

I. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.

J. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion-resistant.

K. Nails for Attachment to Wood Members: ASTM C514.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 SHAFT WALL INSTALLATION

A. Shaft Wall Framing: Install in accordance with manufacturer's installation instructions.

B. Shaft Wall Liner: Cut panels to accurate dimensions and install sequentially between special friction studs.

3.03 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
   1. Place two beads continuously on substrate before installation of perimeter framing members.
   2. Place continuous bead at perimeter of each layer of gypsum board.
   3. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.04 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.

C. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

D. Cementitious Backing Board: Install over steel framing members and plywood substrate where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.

E. Installation on Wood Framing: For rated assemblies, comply with requirements of listing authority. For nonrated assemblies, install as follows:
   1. Single-Layer Applications: Screw attachment.

3.05 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
   1. Not more than 30 feet apart on walls and ceilings over 50 feet long.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

D. Decorative Trim: Install at locations shown on drawings and in accordance with manufacturer's instructions.

3.06 JOINT TREATMENT

A. Paper Faced Gypsum Board: Use paper joint tape, embed with drying type joint compound and finish with drying type joint compound.

B. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
   2. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
   3. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.

C. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   1. Feather coats of joint compound so that camber is maximum 1/32 inch.

D. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

3.07 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION

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SECTION 09 22 16
NON-STRUCTURAL METAL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal partition, ceiling, and soffit framing.

B. Framing accessories.

1.02 RELATED REQUIREMENTS

A. Section 05 21 00 - Steel Joists: Execution requirements for anchors for attaching work of this section.

B. Section 05 40 00 - Cold-Formed Metal Framing: Requirements for structural, load-bearing, metal stud framing and exterior wall stud framing.

C. Section 05 50 00 - Metal Fabrications: Metal fabrications attached to stud framing.

D. Section 06 10 00 - Rough Carpentry: Wood blocking within stud framing.

E. Section 06 10 00 - Rough Carpentry: Wall sheathing.

F. Section 07 21 00 - Thermal Insulation: Acoustic insulation.

G. Section 07 25 00 - Weather Barriers.

H. Section 07 92 00 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

I. Section 08 31 00 - Access Doors and Panels.

1.03 REFERENCE STANDARDS

A. AISI S100-12 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2012.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.

C. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2018.

D. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2018.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data describing framing member materials and finish, product criteria, load charts, and limitations.

C. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience and approved by manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Framing, Connectors, and Accessories:
   1. CEMCO: www.cemcosteel.com/#sle.
   2. ClarkDietrich: www.clarkdietrich.com/#sle.
   3. Marino: www.marinoware.com/#sle.
   4. SCAFCO Corporation: www.scafco.com/#sle.
   5. Simpson Strong Tie: www.strongtie.com/#sle.
   6. Steel Construction Systems: www.steelconsystems.com/#sle.

7. Super Stud Building Products, Inc: www.buysuperstud.com/#sle.
8. The Steel Network, Inc: www.SteelNetwork.com/#sle.
9. Or approved equal.

2.02 FRAMING MATERIALS

A. Fire-Resistance-Rated Assemblies: Comply with applicable code and as follows:
   1. Fire-Resistance-Rated Partitions: Listed assembly by UL, No. V 473; 1 hour rating or as listed on sheet AG1.1 based on wall construction.

B. Loadbearing Studs: As specified in Section 05 40 00.

C. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf.
   1. Studs: C shaped with knurled or embossed faces.
   2. Runners: U shaped, sized to match studs.
   3. Furring: Hat-shaped sections, minimum depth of 7/8 inch.
   4. C-H Studs: At shaft walls, as indicated on drawings.
   5. Resilient Furring Channels: Single or double leg configuration; 1/2 inch channel depth.

D. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws, and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.
   1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100-12.
   2. Material: ASTM A653/A653M steel sheet, SS Grade 50, with G60/Z180 hot-dipped galvanized coating.

E. Deflection and Firestop Track: Intumescent strip factory-applied to track flanges expands when exposed to heat or flames to provide a perimeter joint seal.

F. Non-Loadbearing Framing Accessories:
   1. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
   2. Partial Height Wall Framing Support: Provides stud reinforcement and anchored connection to floor.

2.03 FABRICATION

A. Fabricate assemblies of framed sections to sizes and profiles required.

B. Fit, reinforce, and brace framing members to suit design requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that rough-in utilities are in proper location.

3.02 INSTALLATION OF STUD FRAMING

A. Comply with requirements of ASTM C754.

B. Extend partition framing to structure where indicated and to ceiling in other locations.

C. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.

D. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.

E. Align and secure top and bottom runners at 24 inches on center.

F. At partitions indicated with an acoustic rating:

1. Place two beads of acoustic sealant between runners and substrate , studs and adjacent construction.
2. Place two beads of acoustic sealant between studs and adjacent vertical surfaces.

G. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.

H. Install studs vertically at 16 inches on center.

I. Align stud web openings horizontally.

J. Secure studs to tracks using crimping method. Do not weld.

K. Stud splicing is not permissible.

L. Fabricate corners using a minimum of three studs.

M. Install double studs at wall openings, door and window jambs, not more than 2 inches from each side of openings.

N. Brace stud framing system rigid.

O. Coordinate erection of studs with requirements of door frames; install supports and attachments.

P. Coordinate installation of bucks, anchors, and blocking with electrical, mechanical, and other work to be placed within or behind stud framing.

Q. Blocking: Use wood blocking secured to studs. Provide blocking for support of plumbing fixtures, toilet partitions, wall cabinets, toilet accessories, hardware, and opening frames.

R. Furring: Install at spacing and locations shown on drawings. Lap splices a minimum of 6 inches.

3.03 CEILING AND SOFFIT FRAMING

A. Comply with requirements of ASTM C754.

B. Install furring after work above ceiling or soffit is complete. Coordinate the location of hangers with other work.

C. Install furring independent of walls, columns, and above-ceiling work.

D. Securely anchor hangers to structural members or embed them in structural slab. Space hangers as required to limit deflection to criteria indicated. Use rigid hangers at exterior soffits.

E. Space main carrying channels at maximum 72 inch on center, and not more than 6 inches from wall surfaces. Lap splice securely.

F. Securely fix carrying channels to hangers to prevent turning or twisting and to transmit full load to hangers.

G. Place furring channels perpendicular to carrying channels, not more than 2 inches from perimeter walls, and rigidly secure. Lap splices securely.

H. Reinforce openings in suspension system that interrupt main carrying channels or furring channels with lateral channel bracing. Extend bracing minimum 24 inches past each opening.

I. Laterally brace suspension system.

3.04 TOLERANCES

A. Maximum Variation From True Position: 1/8 inch in 10 feet.

B. Maximum Variation From Plumb: 1/8 inch in 10 feet.

END OF SECTION

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SECTION 09 23 00
GYPSUM PLASTERING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Gypsum plastering.
   1. **Repair at deteriorated plaster within historic library building.**

B. Gypsum lath.

1.02 REFERENCE STANDARDS

A. ASTM A924/A924M - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process; 2019.

B. ASTM C28/C28M - Standard Specification for Gypsum Plasters; 2010 (Reapproved 2015).

C. ASTM C206 - Standard Specification for Finishing Hydrated Lime; 2014.

D. ASTM C631 - Standard Specification for Bonding Compounds for Interior Gypsum Plastering; 2009 (Reapproved 2020).

E. ASTM C841 - Standard Specification for Installation of Interior Lathing and Furring; 2003 (Reapproved 2018).

F. ASTM C842 - Standard Specification for Application of Interior Gypsum Plaster; 2005 (Reapproved 2015).

G. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittals procedures.

B. Product Data: Provide data on plaster materials, characteristics, and limitations of products specified.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum 3 years documented experience.

1.05 MOCK-UP

A. Construct mock-up of interior wall, 4 feet long by 4 feet wide, illustrating surface finish.

B. Locate as indicated on drawings at locations within the historic library building.

C. Mock-up may remain as part of the Work.

1.06 FIELD CONDITIONS

A. Do not apply plaster when substrate or ambient air temperature is under 50 degrees F or over 80 degrees F.

B. Maintain minimum ambient temperature of 50 degrees F during and after installation of plaster.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Gypsum Plaster:
   1. National Gypsum Company: www.nationalgypsum.com/#sle.
   2. USG: www.usg.com/#sle.
   3. Or Approved Equal.

2.02 PLASTER MATERIALS

A. Gypsum Neat Plaster: ASTM C28/C28M; fibered.

B. Ready-Mixed Gypsum Plaster: ASTM C28/C28M; mill-mixed type, requiring only the addition of water.

C. Lime: ASTM C206, Type S; special finishing hydrated lime.

D. Ready-Mixed Finishing Plaster: Gypsum/Lime putty type, ASTM C28/C28M; mixture of gauging plaster and lime.

E. Aggregate for Finish Coats: As specified in ASTM C842.

F. Water: Clean, fresh, potable and free of mineral or organic matter that could adversely affect plaster.

G. Bonding Agent: ASTM C631 Type recommended for bonding plaster to monolithic concrete surfaces.

2.03 LATH AND ACCESSORIES

A. Gypsum Lath: ASTM C1396/C1396M, standard type.
   1. Thickness: 3/8 inch.

B. Finishing Accessories: ASTM C841, extruded aluminum alloy (6063 T5), galvanized steel sheet ASTM A924/A924M G90, galvanized steel wire, or rolled zinc, unless noted otherwise.
   1. Types: As detailed or required for finished appearance.
   2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead at exposed plaster edges.

C. Beads, Screeds, Joint Accessories, and Other Trim: Depth governed by plaster thickness, maximum possible lengths.
   1. Material: Formed aluminum, solid flanges.

D. Corner Mesh: Formed sheet steel, minimum 0.018 inch thick, perforated flanges shaped to permit complete embedding in plaster, minimum 2 inch size; galvanized.

E. Strip Mesh: Expanded metal lath, minimum 0.018 inch thick, 2 inch wide by 24 inch long; galvanized.

F. Fasteners: Nails, staples, or other approved metal supports, of type and size to suit application, to rigidly secure accessories in place.

2.04 PLASTER MIXES

A. Over Gypsum Lath: Two-coat application, ready-mixed plaster, mixed and proportioned in accordance with ASTM C842 and manufacturer's instructions.

B. Over Other Solid Bases: Two-coat application, ready-mixed plaster, mixed and proportioned in accordance with ASTM C842 and manufacturer's instructions.

C. Ready-Mixed Plaster Materials: Mix in accordance with manufacturer's instructions.

D. Finish Coat for Floated Finish: Lime putty with gypsum gauging plaster, mixed and proportioned in accordance with ASTM C842.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing conditions are satisfactory before starting work.

B. Grounds and Blocking: Verify items within walls for other sections of work have been installed.

C. Gypsum Lath and Accessories: Verify substrate is flat and surface is ready to receive work of this section. Verify joint and surface perimeter accessories are in place.

D. Mechanical and Electrical: Verify services within walls have been tested and approved.

3.02 PREPARATION

A. Apply bonding agent in accordance with manufacturer's instructions.

3.03 INSTALLATION - GYPSUM LATH AND ACCESSORIES

A. Install gypsum lath in accordance with ASTM C841.

B. Install gypsum lath perpendicular to framing members, with lath face exposed. Stagger end joint of alternate courses. Butt joints tight. Maximum gap allowed: 1/8 inch.

C. Place corner reinforcement diagonally over gypsum lath and across corner immediately above and below openings. Secure to gypsum lath only.

D. Continuously reinforce internal angles with corner mesh, return 3 inches from corner to form the angle reinforcement; fasten at perimeter edges only.

E. Place corner bead at external wall corners; fasten at outer edges of lath only.

F. Place strip mesh diagonally at corners of lathed openings. Secure rigidly in place.

G. Place 4 inch wide strips of strip mesh centered over junctions of dissimilar backing materials. Secure rigidly in place.

H. Place casing beads at terminations of plaster finish. Butt and align ends. Secure rigidly in place.

I. Control and Expansion Joints:
   1. Locate at 20 feet on center.

3.04 PLASTERING

A. Apply gypsum plaster in accordance with ASTM C842 and manufacturer's instructions.

B. Thickness of Plaster including Finish Coat:
   1. Over gypsum lath: 1/2 inch.

C. Finish Texture: Float to a consistent and smooth finish.

3.05 TOLERANCES

A. Maximum Variation from True Flatness: 1/8 inch in 10 feet.

END OF SECTION

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SECTION 09 30 00
TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tile for floor applications.

B. Tile for wall applications.

C. Ceramic accessories.

D. Crack Isolation Membrane.

E. Non-ceramic trim.

1.02 RELATED REQUIREMENTS

A. Section 07 92 00 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.

B. Section 09 21 16 - Gypsum Board Assemblies: Tile backer board.

1.03 REFERENCE STANDARDS

A. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar; 2017.

B. ANSI A108.1b - Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set, Modified Dry-Set, or Improved Modified Dry-Set Cement Mortar; 2023.

C. ANSI A108.1c - Contractor's Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set, Modified Dry-Set, or Improved Modified Dry-Set Cement Mortar; 2023.

D. ANSI A108.2 - American National Standard General Requirements: Materials, Environmental and Workmanship; 2019.

E. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesive or Water Cleanable Tile-Setting Epoxy Adhesive; 2023.

F. ANSI A108.5 - Setting of Ceramic Tile with Dry-Set Cement Mortar, Modified Dry-Set Cement Mortar, EGP (Exterior Glue Plywood) Modified Dry-Set Cement Mortar, or Improved Modified Dry-Set Cement Mortar; 2023.

G. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grout Epoxy; 2023.

H. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout; 1999 (Reaffirmed 2024).

I. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout; 2023.

J. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework; 2017 (Reaffirmed 2022).

K. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2018.

L. ANSI A108.12 - Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Modified Dry-Set Mortar; 2023.

M. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone; 2005 (Reaffirmed 2016).

N. ANSI A108.19 - American National Standard Specifications for Interior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs by the Thin-Bed Method Bonded with

Modified Dry-Set Cement Mortar or Improved Modified Dry-Set Cement Mortar; 2020.

O. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation; 2010 (Reaffirmed 2016).

P. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 1999 (Reaffirmed 2016).

Q. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation; 2014.

R. ANSI A118.15 - American National Standard Specifications for Improved Modified Dry-Set Cement Mortar; 2012.

S. ANSI A137.1 - American National Standard Specifications for Ceramic Tile; 2022.

T. ASTM C373 - Standard Test Methods for Determination of Water Absorption and Associated Properties by Vacuum Method for Pressed Ceramic Tiles and Glass Tiles and Boil Method for Extruded Ceramic Tiles and Non-tile Fired Ceramic Whiteware Products; 2018.

U. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2019, with Editorial Revision (2020).

V. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2016a.

W. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

X. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2021.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by affected installers.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.

D. Samples: Mount tile and apply grout on two plywood panels, minimum 18 by 18 inches in size illustrating pattern, color variations, and grout joint size variations.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.

G. Maintenance Materials: Furnish the following for Owner / Library's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Tile: 2 percent of each size, color, and surface finish combination.

1.06 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Company specializing in performing tile installation, with minimum of five years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Maintain ambient and substrate temperature above 50 degrees F and below 100 degrees F during installation and curing of setting materials.

PART 2 PRODUCTS

2.01 TILE

A. Ceramic Tile: ANSI A137.1 standard grade.
   1. Moisture Absorption: 7.0 to 20.0 percent as tested in accordance with ASTM C373.
   2. Surface Finish: Matte glazed.
   3. Color(s): As indicated in Section 09 00 00 "Finish and Material Legend".
   4. Pattern: As indicated on drawings.
   5. Products:
      a. As indicated in Section 09 00 00 "Finish and Material Legend".

B. Glazed Wall Tile: ANSI A137.1 standard grade.
   1. Moisture Absorption: 7.0 to 20.0 percent as tested in accordance with ASTM C373.
   2. Surface Finish: High gloss.
   3. Color(s): As indicated in Section 09 00 00 "Finish and Material Legend".
   4. Pattern: As indicated on drawings.
   5. Products:
      a. As indicated in Section 09 00 00 "Finish and Material Legend".

2.02 TRIM AND ACCESSORIES

A. Metal Edge Trim: Satin natural anodized extruded aluminum, style and dimensions to suit application, for setting using tile mortar or adhesive.
   1. Applications:
      a. Open edges of wall tile and as noted below or in the drawings:
         1) Basis of Design: Schluter in brushed nickel anodized aluminum.
      b. Wall corners, outside: RONDEC.
      c. Transition between floor finishes of different heights - RENO-U.
      d. Floor to Wall Cove: DILEX-AHK.
   2. Manufacturers:
      a. Schluter-Systems: www.schluter.com/#sle.
      b. Genesis APS International: www.genesis-aps.com/#sle.
      c. Or approved equal.

2.03 SETTING MATERIALS

A. Improved Latex-Portland Cement Mortar Bond Coat: ANSI A118.15.
   1. Applications: Use this type of bond coat where Large and Heavy Tile (LHT) mortar is indicated.
   2. Products:
      a. LATICRETE International, Inc; MULTIMAX LITE: www.laticrete.com/#sle.
      b. TEC, an H.B. Fuller Construction Products Brand; TEC 3N1 Performance Mortar: www.tecspecialty.com/#sle.
      c. Or Approved Equal.

2.04 GROUTS

A. Manufacturers:
   1. ARDEX Engineered Cements: www.ardexamericas.com/#sle.
   2. Bostik Inc: www.bostik-us.com/#sle.
   3. Custom Building Products: www.custombuildingproducts.com/#sle.
   4. LATICRETE International, Inc: www.laticrete.com/#sle.
   5. Mapei: www.mapei.com
   6. Merkrete, by Parex USA, Inc: www.merkrete.com/#sle.

7. TEC, an H.B. Fuller Construction Products Brand: www.tecspecialty.com/#sle.
8. Or approved equal.

B. High Performance Polymer Modified Grout: ANSI A118.7 polymer modified cement grout.
1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.
2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide. **Use unsanded grout at glazed tile locations.**
3. Color(s): As indicated in Specification Section 09 00 00 "Finish and Material Legend".

2.05 MAINTENANCE MATERIALS

A. Tile Sealant: Gunnable, silicone, siliconized acrylic, or urethane sealant; moisture and mildew resistant type.
1. Applications: Between tile and plumbing fixtures.
2. Color(s): Provide sanded color matched sealant to match grout.

B. Grout Sealer: Liquid-applied, moisture and stain protection for existing or new Portland cement grout.
1. Composition: Water-based colorless silicone.

2.06 ACCESSORY MATERIALS

A. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12; not intended as waterproofing.
1. Crack Resistance: No failure at 1/8 inch gap, minimum.
2. Fluid or Trowel Applied Type:
a. Material: Synthetic rubber, Acrylic, or PVC.
b. Thickness: 40 mils, maximum.
c. Products:
1) LATICRETE International, Inc; LATICRETE Blue 92 Anti-Fracture Membrane: www.laticrete.com/#sle.
2) Merkrete, by Parex USA, Inc; Merkrete Fracture Guard: www.merkrete.com/#sle.
3) Noble Company; NobleSealCIS.
4) TEC, an H.B. Fuller Construction Products Brand; TEC HydraFlex Waterproofing Crack Isolation Membrane: www.tecspecialty.com/#sle.
5) Or approved equal.

B. Backer Board: Cementitious type complying with ANSI A118.9; high density, glass fiber reinforced, 1/2 inch thick; 2 inch wide coated glass fiber tape for joints and corners.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.

C. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.

D. Cementitious Subfloor Surfaces: Verify that substrates are ready for tiling installation by testing for moisture and alkalinity (pH).
1. Test as Follows:
a. Alkalinity (pH): ASTM F710.
b. Internal Relative Humidity: ASTM F2170.
c. Moisture Vapor Emission: ASTM F1869.
2. Obtain instructions if test results are not within limits recommended by tiling material manufacturer and setting material manufacturer.

E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Protect surrounding work from damage.

B. Vacuum clean surfaces and damp clean.

C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.

3.03 INSTALLATION - GENERAL

A. Install tile, thresholds, and stair treads and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.19 , manufacturer's instructions, and TCNA (HB) recommendations.

B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.

C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.

D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.

E. Form internal angles square and external angles bullnosed.

F. Install ceramic accessories rigidly in prepared openings.

G. Install non-ceramic trim in accordance with manufacturer's instructions.

H. Sound tile after setting. Replace hollow sounding units.

I. Keep control and expansion joints free of mortar, grout, and adhesive.

J. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

K. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.

L. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.04 INSTALLATION - FLOORS - THIN-SET METHODS

A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with standard grout, unless otherwise indicated.

3.05 INSTALLATION - WALL TILE

A. Over cementitious backer units on studs, install in accordance with TCNA (HB) Method W244, using membrane at toilet rooms.

3.06 CLEANING

A. Clean tile and grout surfaces.

3.07 PROTECTION

A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION

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SECTION 09 51 00
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

1.02 RELATED REQUIREMENTS

A. Section 26 51 00 - Interior Lighting: Light fixtures in ceiling system.

B. Section 28 46 00 - Fire Detection and Alarm: Fire alarm components in ceiling system.

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.

B. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2017.

C. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2019.

D. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2020.

E. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2019.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Do not install acoustical units until after interior wet work is dry.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on suspension system components and acoustical units.

C. Samples: Submit two samples 6 by 6 inch in size illustrating material and finish of acoustical units.

D. Coordination Drawings:
   1. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
      a. Suspended ceiling components.
      b. Structural members to which suspension systems will be attached.
      c. Size and location of initial access modules for acoustical panels.
      d. Items penetrating finished ceiling including the following:
         1) Lighting fixtures.
         2) Air outlets and inlets.
         3) Speakers.
         4) Sprinklers.
         5) Access panels.
      e. Perimeter moldings.

E. Maintenance Materials: Furnish the following for Owner / Library's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.

2. Extra Acoustical Units: Quantity equal to 5 percent of total installed.

1.06 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acoustic Tiles/Panels (ACT-1 and ACT-2):
   1. Armstrong World Industries, Inc: www.armstrongceilings.com/#sle.
   2. CertainTeed Corporation: www.certainteed.com/#sle.
   3. Hunter Douglas Architectural: www.hunterdouglasarchitectural.com/#sle.
   4. USG Corporation: www.usg.com/ceilings/#sle.
   5. Or approved equal.

B. Suspension Systems:
   1. Same as for acoustical units.

2.02 ACOUSTICAL UNITS

A. Acoustical Units - General: ASTM E1264, Class A.

B. Acoustical Panels, Type ACT-1 and ACT-2: Mineral fiber with membrane-faced overlay, with the following characteristics:
   1. Classification: ASTM E1264 Type IV.
   2. Size: 24 by 24 inches.
   3. Thickness: 3/4 inch.
   4. Light Reflectance: 0.90 percent, determined in accordance with ASTM E1264.
   5. NRC Range: 0.70, determined in accordance with ASTM E1264.
   6. Ceiling Attenuation Class (CAC): 35, determined in accordance with ASTM E1264.
   7. Panel Edge:
      a. Tile Edge at ACT-1: SLT / Tegular.
      b. Tile Edge at ACT-2: Square
   8. Color: White.
   9. Suspension System: Exposed grid.
   10. Basis of Design Product:
      a. ACT-1 - USG Corporation; Mars ClimaPlus Performance, Fine Texture: www.usg.com/ceilings/#sle.
      b. ACT-2 - USG Corporation;Mars Healthcare, Fine Texture: www.usg.com/ceilings/#sle.

2.03 SUSPENSION SYSTEM(S)

A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, stabilizer bars, clips, and splices as required.
   1. Materials:
      a. Steel Grid: ASTM A653/A653M, G30 coating, unless otherwise indicated.

B. Exposed Suspension System: Hot-dipped galvanized steel grid and cap.
   1. Structural Classification: Heavy-duty, when tested in accordance with ASTM C635/C635M.
   2. Profile: Tee; 15/16 inch face width at ACT-1 & 2.
   3. Finish: Baked enamel.
   4. Color: White

2.04 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

B. Hanger Wire: 12-gage 0.08 inch galvanized steel wire.

C. Hold-Down Clips: Manufacturer's standard clips to suit application **- in vestibules and at exterior doors**.

D. Perimeter Moldings: Same metal and finish as grid.

E. Metal Edge Trim for "Cloud" Suspension Systems: Steel or extruded aluminum; provide attachment clips, splice plates, and preformed corner pieces for complete trim system.
   1. Trim Height: 6 inch.
   2. Finish: Baked enamel.
   3. Color: White.
   4. Products:
      a. USG Corporation; Compasso Suspension Trim: www.usg.com/ceilings/#sle.
      b. Or Approved Equal.

F. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.02 PREPARATION

A. Install after major above-ceiling work is complete.

B. Coordinate the location of hangers with other work.

3.03 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.

B. Suspend ceiling hangers from building's structural members and as follows:
   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
   2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
   4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structures that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
      a. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
      b. Do not attach hangers to steel deck tabs.
      c. Do not attach hangers to steel roof deck. Attach hangers to structural members.
      d. Space hangers not more than 48 inches o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
      e. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
      f. Install minimum of four (4) wire hangers at light fixtures, within 6-inches from each corner of the light fixture.
   5. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs.

C. Support for Recessed and Semi-recessed Grid-Type Light Fixtures: Units may be supported from suspended ceiling support system. Install ceiling support system rods or wires at a minimum of 4 rods or wires for each fixtures, located not more than 6 inches from fixture corners.
   1. Install support clips for recessed fixtures, securely fastened to ceiling grid members, at or near each fixture corner.
   2. Fixtures of Sizes less than Ceiling Grid: Center in acoustical panel. Support fixtures independently with at least two ¾-inch metal channels spanning and secured to ceiling tees.

D. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

E. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
   1. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
   2. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

F. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

G. Lay out system to a balanced grid design with edge units no less than 50 percent of acoustical unit size.

H. Locate system on room axis according to reflected ceiling plan.

I. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Use longest practical lengths.
   2. Overlap and rivet corners.

J. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

K. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

L. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

M. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.

N. Do not eccentrically load system or induce rotation of runners.

3.04 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Lay directional patterned units with pattern parallel to longest room axis.

D. Fit border trim neatly against abutting surfaces.

E. Install units after above-ceiling work is complete.

F. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

G. Cutting Acoustical Units:
   1. Cut to fit irregular grid and perimeter edge trim.

2. Make field cut edges of same profile as factory edges.

H. Where round obstructions occur, provide preformed closures to match perimeter molding.

3.05 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

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SECTION 09 54 26
SUSPENDED WOOD CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wood grilles.

B. Metal suspension system.

1.02 REFERENCE STANDARDS

A. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2017.

B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2019.

C. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2020.

D. CISCA (WC) - Wood Ceilings Technical Guidelines; 2009.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Sequence work to ensure ceilings are not installed until building is enclosed, dust generating activities have terminated, and overhead work is completed.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate grid layout and related dimensioning, attachment of wood ceiling components to grid, accessory attachments, junctions with other ceiling finishes, and mechanical and electrical items installed in the ceiling.

C. Product Data: Provide data on wood ceiling components and suspension system components.

D. Samples: Submit two full size samples illustrating material and finish of wood ceiling components.

E. Samples: Submit two samples each, 12 inches long, of suspension system main runner, cross runner, and perimeter molding.

F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

G. Manufacturer's Qualification Statement.

H. Maintenance Materials: Furnish the following for Owner / Library's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Wood Ceiling Components: Provide a quantity equal to 2 percent of total product installed.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver wood ceiling components to project site in original, unopened packages.

B. Store in fully enclosed space, flat, level and off the floor.

1.07 FIELD CONDITIONS

A. Do not install suspended wood ceiling system until wet construction work is complete and permanent heat and air conditioning is installed and operating.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Suspended Wood Ceilings:
   1. 9Wood: www.9wood.com/#sle.
   2. Armstrong World Industries, Inc; Woodworks: www.armstrongceilings.com/#sle.
   3. USG Corporation: www.usg.com/ceilings/#sle.

2.02 SUSPENDED WOOD CEILING SYSTEM

A. Performance Requirements:
   1. Design for maximum deflection of 1/360 of span.
   2. Wood ceilings to meet Surface Burining Characteristics of ASTM E: Class A flame spread requirements.

B. Wood-Based Materials:
   1. Composite Wood Panels: Containing no urea-formaldehyde resin binders.

C. Wood Grilles - Type WG-1: Pre-assembled module of solid wood grilles with backer only.
   1. Module Size: 12 by 96 inches, nominal.
   2. Grille Size: 5/8 inch width by 3 1/4" depth.
   3. Grille Spacing (Reveal): 1 3/4 inch.
   4. Acoustical Backer: Fiberglass, 1 inch thick.
      a. Color: Black.
   5. Solid Wood Species: Poplar.
      a. Factory Finish: Wood stain as selected, clear sealer top coat.
   6. Attachment to Suspension Grid: Manufacturer's recommended method according to panel product selected.
   7. Products:
      a. Armstrong Ceilings; WoodWorks Grille.
      b. Geometrik – Geopanel Grille Wood Ceiling Panels
      c. Madrid, Inc; Grille Wood: www.madridinc.com/#sle.
      d. Or Approved Equal.

D. Metal Suspension System:
   1. General: Comply with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.
   2. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement.

E. Accessories: Manufacturer's standard accessories for installation method indicated, seismic requirements and above-ceiling accessibility.

2.03 FABRICATION

A. Shop fabricate wood ceiling components to the greatest extent possible.

B. Fabricate components to allow access to ceiling plenum as required.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Do not install ceiling until after interior wet work is dry.

3.02 PREPARATION

A. Coordinate the location of hangers with other work.

B. **Coordinate the location of light fixtures, work by other disciplines, and wood slats. Notify Architect of conflicts during shop drawing process.**

C. Layout wood ceiling components in pattern according to reflected ceiling plan and as shown on shop drawings.

D. Acclimate wood ceiling materials by removing from packaging in installation area a minimum of 48 hours prior to installation.

3.03 INSTALLATION

A. General: Install suspended wood ceiling system in accordance with CISCA (WC).

B. Suspension System:
   1. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.
   2. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
   3. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
   4. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
   5. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
   6. Do not eccentrically load system or induce rotation of runners.

C. Wood Ceiling:
   1. Install wood ceilings in accordance with manufacturer's instructions.
   2. Fit wood components in place, free from damaged edges or other defects detrimental to appearance and function.
   3. Install components in uniform plane, and free from twist, warp, and dents.
   4. Cut to fit irregular grid and perimeter edge trim.
   5. Make field cut edges of same profile as factory edges, seal and finish according to manufacturer.
   6. Install clips, stabilizer bars, and other attachments as indicated to secure wood ceiling components tight to the grid system.
   7. Install acoustical backer above wood ceiling components; fit tight between grid members.

3.04 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

3.05 CLEANING

A. Clean and touch up minor finish damage. Remove and replace components that cannot be successfully cleaned and repaired.

END OF SECTION

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SECTION 09 65 00
RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient tile flooring.

B. Resilient base.

C. Installation accessories.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied resilient flooring.

1.03 REFERENCE STANDARDS

A. ASTM F1700 - Standard Specification for Solid Vinyl Floor Tile; 2020.

B. ASTM F1861 - Standard Specification for Resilient Wall Base; 2016.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

C. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.

D. Verification Samples: Submit two samples, 12 by 12 inch in size illustrating color and pattern for each resilient flooring product specified.

E. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.

F. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of subfloor is acceptable.

G. Manufacturer's Qualification Statement.

H. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

I. Maintenance Materials: Furnish the following for Owner / Library's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Flooring Material: One box for every 50 boxes or fraction therof, of each type and color.
   3. Extra Wall Base: 10 linear feet for every 500 linear feet or fraction thereof, of each type and color.
   4. Extra Stair Materials: Quantity equivalent to 5 percent of each type and color.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified flooring with minimum three years documented experience.

B. Installer Qualifications: Company specializing in installing specified flooring with minimum three years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.

B. Store all materials off of the floor in an acclimatized, weather-tight space.

C. Maintain temperature in storage area between 55 degrees F and 90 degrees F.

1.07 FIELD CONDITIONS

A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

PART 2 PRODUCTS

2.01 TILE FLOORING

A. Vinyl Tile - Type LVT-1, LVT-2A, LVT-2B, LVT-3, LVT-4, LVT-5, LVT-6: Printed film type, with transparent or translucent wear layer; acoustic interlayer or backing.
   1. Manufacturers:
      a. Burke Flooring: www.burkeflooring.com/#sle.
      b. Interface; https://www.interface.com/US/en-US/homepage
      c. Johnsonite, a Tarkett Company: www.johnsonite.com/#sle.
      d. Metroflor Corporation: www.aspectaflooring.com/#sle.
      e. Nora, by Interface: https://www.nora.com/united-states/en.
      f. Shannon Specialty Floors, Inc: www.shannonspecialtyfloors.com/#sle.
      g. TAJ Flooring: www.tajflooring.com/#sle.
      h. Or approved equal.
   2. Minimum Requirements: Comply with ASTM F1700, Class III.
   3. Plank Tile Size: As indicated in specification section 09 00 00.
   4. Wear Layer Thickness: 0.020 inch.
   5. Total Thickness: 0.20 inch.
   6. Color: As indicated in Section 09 00 00 "Finish and Material Legend".

2.02 RESILIENT BASE

A. Resilient Base - Type RB-1: ASTM F1861, Type TV, vinyl, thermoplastic; style as scheduled.
   1. Manufacturers:
      a. Armstrong World Industries, Inc.
      b. Burke Flooring: www.burkeflooring.com/#sle.
      c. Endura Rubber Flooring
      d. Johnsonite, a Tarkett Company: www.johnsonite.com/#sle.
      e. Mannington Works: www.manningtoncommercial.com
      f. Nora, by Interface: https://www.nora.com/united-states/en.
      g. Roppe Corp: www.roppe.com/#sle.
      h. Tarkett: www.commercial.tarkett.com
      i. Or approved equal.
   2. Height: 4 inch.
   3. Thickness: 0.125 inch.
   4. Finish: Satin.
   5. Length: Roll.
   6. Color: As indicated in Section 09 00 00 "Finish and Material Legend".
   7. Accessories: Premolded external corners and internal corners.

2.03 ACCESSORIES

A. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.

B. Adhesive for Vinyl and Rubber Flooring as recommended by manufacturer.

C. Moldings, Transition and Edge Strips: Same material as flooring.
   1. Manufacturers:
      a. Armstrong World Industries, Inc.
      b. Burke Flooring; Mercer Vinyl Mouldings: www.burkeflooring.com/#sle.
      c. Endura Rubber Flooring
      d. Mannington Works: www.manningtoncommercial.com

e. Nora, by Interface: https://www.nora.com/united-states/en.
f. Roppe: www.roppe.com
g. Tarkett: www.commercial.tarkett.com
h. Or approved equal.

D. Sealer and Wax: Types recommended by flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.

C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
   1. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

3.02 PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

B. Remove subfloor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface.

C. Prohibit traffic until filler is fully cured.

D. Clean substrate.

E. Apply primer as required to prevent "bleed-through" or interference with adhesion by substances that cannot be removed.

3.03 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install in accordance with manufacturer's written instructions.

C. Adhesive-Applied Installation:
   1. Spread only enough adhesive to permit installation of materials before initial set.
   2. Place copper grounding strip in conductive adhesive and apply additional adhesive to top side of strip before installing static control flooring. Allow strip to extend beyond flooring in accordance with static control flooring manufacturer's instructions. Refer to Section 26 05 26 for grounding and bonding to building grounding system.
   3. Fit joints and butt seams tightly.
   4. Set flooring in place, press with heavy roller to attain full adhesion.

D. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.

E. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
   1. Resilient Strips: Attach to substrate using adhesive.

F. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

G. Install flooring in recessed floor access covers, maintaining floor pattern.

3.04 INSTALLATION - TILE FLOORING

A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.

B. Lay flooring with joints and seams parallel to building lines to produce symmetrical pattern or as indicated on finish plans.

C. Install square tile to monolithic pattern. Allow minimum 1/2 full size tile width at room or area perimeter.

3.05 INSTALLATION - RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.

B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.

C. Install base on solid backing. Bond tightly to wall and floor surfaces.

D. Scribe and fit to door frames and other interruptions.

3.06 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's written instructions.

3.07 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION

SECTION 09 68 13
TILE CARPET

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Carpet tile, fully adhered.

B. Matching roll carpet for direct glue installation on stairs.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied flooring.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

C. Shop Drawings: Indicate layout of joints and direction of carpet pile.

D. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.

E. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.

F. Installer's Qualification Statement.

G. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

H. Maintenance Materials: Furnish the following for Owner / Library's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.
   3. Extra Roll Carpet: 20 sq ft of each type, color, and pattern installed.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet tile with minimum three years documented experience.

B. Installer Qualifications: Company specializing in installing carpet tile with minimum three years documented experience and approved by carpet tile manufacturer.

1.05 FIELD CONDITIONS

A. Store materials in area of installation for minimum period of 24 hours prior to installation.

PART 2 PRODUCTS

2.01 MATERIALS

A. Tile Carpet, Type WCPT-1: Tufted, manufactured in one color dye lot.
   1. Product: As indicated in Specification Section 09 00 00 "Finish and Material Legend".
   2. Tile Size: 24 by 24 inch, nominal.
   3. Color: As indicated in Specification Section 09 00 00 "Finish and Material Legend".
   4. Pile Weight: 38 oz/sq yd.

B. Tile Carpet, **Type CPT-1-7**: Textured Patterned Loop, manufactured in one color dye lot.
   1. Product: As indicated in Specification Section 09 00 00 "Finish and Material Legend".
   2. Dye Method: Solution / Yarn.
   3. Tile Size: 24 x 24 inches, nominal.
   4. Pile Weight: 21 oz/sq yd.
   5. Color: As indicated in Specification Section 09 00 00 "Finish and Material Legend".

C. Tile Carpet, Type CPT-8-12: Tufted, manufactured in one color dye lot.
   1. Product: As indicated in Specification Section 09 00 00 "Finish and Material Legend".
   2. Dye Method: Solution Dyed.
   3. Tile Size: 9 x 36 inches, nominal.
   4. Tufted Pile Weight: 20 oz/sq yd.
   5. Color: As indicated in Specification Section 09 00 00 "Finish and Material Legend".

D. Tile Carpet, Type CPT-13: Tufted, manufactured in one color dye lot.
   1. Product: As indicated in Specification Section 09 00 00 "Finish and Material Legend".
   2. Dye Method: Solution Dyed.
   3. Tile Size: 24 x 24 inches, nominal.
   4. Tufted Fiber Weight: 22 oz/sq yd.
   5. Color: As indicated in Specification Section 09 00 00 "Finish and Material Legend".

E. Roll Carpet (CPT-14): Same manufacturer, type, color and pattern, and face fiber characteristics as carpet tile CPT-1, 12.5 feet wide, manufactured in same color dye lot as tile.

2.02 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by flooring material manufacturer.

B. Carpet Tile Adhesive: Recommended by carpet tile manufacturer; releasable type.

C. Provide carpet accessories, as needed, for a complete installation.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.

B. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to subfloor surfaces.

C. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
   1. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

B. Remove subfloor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler.

C. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.

D. Vacuum clean substrate.

3.03 INSTALLATION

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install carpet tile in accordance with manufacturer's instructions.

C. Blend carpet from different cartons to ensure minimal variation in color match.

D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.

E. Lay carpet tile in square pattern, with pile direction parallel to next unit, set aligned as indicated on shop drawings.

F. Locate change of color or pattern between rooms under door centerline.

G. Fully adhere carpet tile to substrate.

H. Trim carpet tile neatly at walls and around interruptions.

I. Complete installation of edge strips, concealing exposed edges.

3.04 INSTALLATION ON STAIRS

A. Use one piece of carpet for each tread and the riser below. Apply seam adhesive to all cut edges.

B. Lay carpet with pile direction in the length of the stair.

C. Adhere carpet tight to stair treads and risers.

3.05 CLEANING

A. Remove excess adhesive without damage, from floor, base, and wall surfaces.

B. Clean and vacuum carpet surfaces.

END OF SECTION

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SECTION 09 72 00
WALL COVERINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall covering.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. ASTM D1308 - Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Coating Systems; 2020.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.

C. ASTM F793/F793M - Standard Classification of Wall Coverings by Use Characteristics; 2020.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on wall covering and adhesive.

C. Shop Drawings: Indicate wall elevations with seaming layout.

D. Samples: Submit two samples of wall covering, 8 by 8 inch in size illustrating color, finish, and texture.

E. Manufacturer's Installation Instructions: Indicate special procedures.

F. Maintenance Data: Submit data on cleaning, touch-up, and repair of covered surfaces.

G. Manufacturer's Qualification Statement.

H. Maintenance Materials: Furnish the following for Owner / Library's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Wall Covering Materials: 25 linear feet of each color and pattern of wall covering; store where directed.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Inspect roll materials at arrival on site, to verify acceptability.

B. Protect packaged adhesive from temperature cycling and cold temperatures.

C. Do not store roll goods on end.

1.07 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the adhesive or wall covering product manufacturer.

B. Maintain these conditions 24 hours before, during, and after installation of adhesive and wall covering.

PART 2 PRODUCTS

2.01 WALL COVERINGS

A. General Requirements:
   1. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84.

2. Chemical and Stain Resistance: No visible staining or discoloration and no damage to surface texture when tested in accordance with ASTM D1308.

B. Wall Covering - Type VWC-1: Fabric-backed vinyl roll stock.
1. Comply with ASTM F793/F793M, Category V, Type II.
2. Pattern: As indicated in Specification Section 09 00 00 - Finish and Materials Legend.

C. Forbo Bulletin Board: Uni-color resilient homogeneous tackable linoleum surface consisting of linseed oil, granulated cork, rosin binders, and dry pigments calendered onto natural burlap backing. Color shall extend through thickness of material. Color to be chosen from Manufacturer's full range.

D. Color-Matched Caulk:
1. Acrylic caulk to match tackble wall color.

E. Adhesive: Type recommended by wall covering manufacturer to suit application to substrate.

F. Termination Trim: 1/4 inch aluminum trim at Tackable Wall Surface.
1. J208-00 Clear satin, anodized aluminum, 5/16 inch face J Trim

G. Q-Pins:
1. 96 Push Pins Translucent.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are prime painted and ready to receive work, and comply with requirements of wall covering manufacturer.

B. Measure moisture content of surfaces using an electronic moisture meter. Do not apply wall coverings if moisture content of substrate exceeds level recommended by wall covering manufacturer.

C. Verify flatness tolerance of surfaces does not vary more than 1/8 inch in 10 feet nor vary at a rate greater than 1/16 inch/ft.

3.02 PREPARATION

A. Wash impervious surfaces with tetra-sodium phosphate, rinse and neutralize; wipe dry.

B. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.

3.03 INSTALLATION

A. Apply adhesive and wall covering in accordance with manufacturer's instructions.

B. Apply adhesive to wall surface immediately prior to application of wall covering.

C. Apply wall covering smooth, without wrinkles, gaps or overlaps. Eliminate air pockets and ensure full bond to substrate surface.

D. Butt edges tightly.

E. Install termination trim.

F. Remove excess adhesive while wet from seam before proceeding to next wall covering sheet. Wipe clean with dry cloth.

END OF SECTION

SECTION 09 84 30
SOUND-ABSORBING CEILING UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sound-absorbing ceiling baffles.

B. Mounting accessories.

1.02 RELATED REQUIREMENTS

A. Section 09 51 00 - Acoustical Ceilings: Ceiling suspension system.

1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's printed data sheets for products specified.

C. Shop Drawings: Fabrication and installation details, panel layout, and fabric orientation.

D. Selection Samples: Manufacturer's color charts for fabric covering, indicating full range of fabrics, colors, and patterns available.

E. Maintenance Materials: Furnish the following for Owner / Library's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Panels: Quantity equal to 5 percent of total installed, but not less than one of each type.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company with not less than five years of experience in manufacturing acoustical products similar to those specified.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect acoustical units from moisture during shipment, storage, and handling. Deliver in factory-wrapped bundles; do not open bundles until units are needed for installation.

B. Store units flat, in dry, well-ventilated space; do not stand on end.

C. Protect edges from damage.

PART 2 PRODUCTS

2.01 FELT SOUND-ABSORBING UNITS

A. General:
   1. Prefinished, factory assembled felt panels.
   2. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.

B. Felt Acoustical Ceiling Units - **ACU-1, 2, 3**:
   1. Baffle Core: Manufacturer's standard Non-woven layered and formed Polyester felt (PET) fiber core.
   2. Basis of Design: MDC Wall, Zintra, Triangle.
   3. Additional Approved Manufacturers:
      a. J2 Systems; PET Baffles
      b. Autex Acoustics
      c. CSI Wall Panels
   4. Size: Triangular, Large and Small.
   5. Thickness: 3/8 inches.

6. Edges: Perimeter edges reinforced by a formulated resin hardener.
7. Corners: Square.
8. Fabric: Non-woven polyester.
9. Color: As indicated in Specification Section 09 00 00 "Finish and Material Legend".
10. Mounting: Vertically suspended from ceiling or structure by one edge of panel.
    a. Mount to grid supporting acoustical tile ceiling above.

C. Felt Acoustical Ceiling Units - **ACU 4**:
1. Baffle Core: Manufacturer's standard Non-woven layered and formed Polyester felt (PET) fiber core.
2. Basis of Design: MDC Wall, Zintra, Turbine.
3. Additional Approved Manufacturers:
    a. J2 Systems
    b. Autex Acoustics
    c. CSI Wall Panels
4. Size: Turbine, 48"
5. Color: As indicated in Specification Section 09 00 00 "Finish and Material Legend".
6. Mounting: Suspended from metal deck above.

2.02 FABRICATION

A. Felt, General: Fabricate panels to sizes and configurations as indicated, with felt installed without sagging, wrinkles, blisters, or visible seams.

2.03 ACCESSORIES

A. Back-Mounting Accessories: Manufacturer's standard accessories for concealed support, designed to allow panel removal, and as follows:
1. As recommended by manufacturer to clip into acoustical ceiling grid above.

B. Ceiling-Suspended Accessories: Manufacturer's standard accessories at locations as indicated on each acoustical unit, sized appropriately for weight of acoustical unit.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates for conditions detrimental to installation of acoustical units. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install acoustical units in locations as indicated, following manufacturer's installation instructions.

B. Align panels accurately, with edges plumb and top edges level. Scribe to fit accurately at adjoining work and penetrations.

C. Suspend ceiling baffles at locations and heights as indicated.

D. Install acoustical units to construction tolerances of plus or minus 1/16 inch for the following:
1. Plumb and level.
2. Flatness.
3. Width of joints.

3.03 CLEANING

A. Clean fabric facing upon completion of installation from dust and other foreign materials, following manufacturer's instructions.

3.04 PROTECTION

A. Provide protection of installed acoustical panels until Date of Substantial Completion.

B. Replace panels that cannot be cleaned and repaired to satisfaction of the Architect.

END OF SECTION

SECTION 09 91 23
INTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
   1. Mechanical and Electrical:
      a. In finished areas, paint conduit, mechanical equipment, and electrical equipment, unless otherwise indicated.

D. Do Not Paint or Finish the Following Items:
   1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
   5. Marble, granite, slate, and other natural stones.
   6. Floors, unless specifically indicated.
   7. Ceramic and other tiles.
   8. Brick, architectural concrete, cast stone, integrally colored plaster and stucco.
   9. Glass.
   10. Acoustical materials, unless specifically indicated.
   11. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

A. Section 05 50 00 - Metal Fabrications: Shop-primed items.

B. Section 05 51 00 - Metal Stairs: Shop-primed items.

C. Section 09 93 00 - Staining and Transparent Finishing: Wood substrates.

D. Section 09 96 00 - High-Performance Coatings.

1.03 DEFINITIONS

A. Comply with ASTM D16 for interpretation of terms used in this section.

1.04 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2016.

C. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2020.

D. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

E. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

F. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. MPI product number (e.g. MPI #47).
   3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
   4. Manufacturer's installation instructions.

C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
   1. Where sheen is specified, submit samples in only that sheen.
   2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens definitely not required.
   3. Allow 30 days for approval process, after receipt of complete samples by Architect.
   4. Paint color submittals will not be considered until color submittals for major materials not to be painted, such as factory finished metals, wood cabinets, and wood doors, have been approved.
   5. Provide paper 'draw down' samples with specified coats cascaded on each sample.

D. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.

E. Maintenance Materials: Furnish the following for Owner / Library's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
   3. Label each container with color in addition to the manufacturer's label.

1.06 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 3 years experience and approved by manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply materials when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F above the dew point; or to damp or wet surfaces.

D. Minimum Application Temperatures for Paints: 50 degrees F for interiors unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

B. Paints:
   1. Benjamin Moore & Co.: www.benjaminmoore.com
   2. Diamond Vogel Paints: www.diamondvogel.com/#sle.
   3. ICI Paints.
   4. Pittsburgh Paints: www.ppgpaints.com/#sle.
   5. Sherwin-Williams Company: www.sherwin-williams.com/#sle.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready mixed, unless intended to be a field-catalyzed paint.
   1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
   2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
   3. Supply each paint material in quantity required to complete entire project's work from a single production run.
   4. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content:
   1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
      a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
      b. Architectural coatings VOC limits of the State in which the Project is located.
   2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

C. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

D. Colors: As indicated in Specification Section 09 00 00 "Finish and Material Legend".
   1. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under.

2.03 PAINT SYSTEMS - INTERIOR

A. Paint I-OP - Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board, concrete, concrete masonry units, brick, wood, plaster, uncoated steel, shop primed steel, and galvanized steel.
   1. Two top coats and one coat primer.
   2. Top Coat(s): Institutional Low Odor/VOC Interior Latex.
      a. Products:
         1) Pittsburgh Paints Speedhide zero Latex, 6-4410XI Series, Satin. (MPI #145)
         2) Sherwin-Williams ProMar 200 Zero VOC Interior Latex, Semi-Gloss.
         3) Or Similar from Approved Manufacturer.

2.04 PRIMERS

A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
   1. Interior Drywall Primer Sealer.

a. Products:
   1) PPG Paints Speedhide Maxbuild High Build Drywall Surfacer
   2) Sherwin Williams High Build Primer
   3) Or similar from approved manufacturer

2. Latex Primer for Interior Wood; MPI #39.
   a. Products:
      1) Pittsburgh Paints Seal Grip Acrylic Primer, 17-921 Series. (MPI #39)
      2) Or similar from approved manufacturer.

2.05 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.

C. Test shop-applied primer for compatibility with subsequent cover materials.

D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Gypsum Wallboard: 12 percent.
   2. Plaster and Stucco: 12 percent.
   3. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
   4. Interior Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.

F. Plaster: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

G. Galvanized Surfaces:
   1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

H. Ferrous Metal:
   1. Solvent clean according to SSPC-SP 1.
   2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
   3. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

I. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried;

sand between coats. Back prime concealed surfaces before installation.

J. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

D. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

E. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.

F. Sand wood and metal surfaces lightly between coats to achieve required finish.

G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

H. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection.

3.05 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.06 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

3.07 SCHEDULE - PAINT SYSTEMS

A. Gypsum Board: Finish surfaces exposed to view.
   1. Interior Ceilings and Bulkheads: GI-OP-3L, flat.
   2. Interior Walls: GI-OP-3A, semi-gloss.
   3. Provide level 5 finish at locations identified for wall graphics.

B. Plaster: Finish surfaces exposed to view.
   1. Interior Walls and Ceilings: GI-OP-2LA.

END OF SECTION

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SECTION 09 93 00
STAINING AND TRANSPARENT FINISHING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of stains and transparent finishes.

1.02 RELATED REQUIREMENTS

A. Section 09 91 23 - Interior Painting: Stains and transparent finishes for concrete substrates.

1.03 DEFINITIONS

A. Comply with ASTM D16 for interpretation of terms used in this section.

1.04 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2016.

C. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2020.

D. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category.
   2. Manufacturer's installation instructions.

C. Samples: Submit two samples, illustrating selected colors and sheens for each system with specified coats cascaded. Submit on actual wood substrate to be finished, 12 x 12 inch in size.

D. Manufacturer's Qualification Statement.

E. Applicator's Qualification Statement.

F. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, safety data sheets (SDS), care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

G. Maintenance Materials: Furnish the following for Owner / Library's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Stain and Transparent Finish Materials: 1 gallon of each color and type; from the same product run, store where directed.
   3. Label each container with color and type in addition to the manufacturer's label.

1.06 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the type of work specified with minimum three years experience and approved by manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of stain or transparent finish, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Stain and Transparent Finish Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by manufacturer of stains and transparent finishes.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply materials when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F above the dew point; or to damp or wet surfaces.

D. Minimum Application Temperature: 50 degrees F unless required otherwise by manufacturer's instructions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide finishes used in any individual system from the same manufacturer; no exceptions.

B. Transparent Finishes:
   1. Pittsburgh Paints Deft Interior Clears/Polyurethanes: www.ppgpaints.com/#sle.
   2. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
   3. Or Approved Equal.

C. Stains:
   1. Pittsburgh Paints Deft Interior Stains: www.ppgpaints.com/#sle.
   2. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
   3. Or Approved Equal.

2.02 STAINS AND TRANSPARENT FINISHES - GENERAL

A. Finishes:
   1. Provide finishes capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
   2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
   3. Supply each finish material in quantity required to complete entire project's work from a single production run.
   4. Do not reduce, thin, or dilute finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content:
   1. Provide stains and transparent finishes that comply with the most stringent requirements specified in the following:
      a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
      b. Architectural coatings VOC limits of the State in which the Project is located.
   2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

C. Flammability: Comply with applicable code for surface burning characteristics.

D. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

E. Colors: As indicated in specification section 09 00 00 "Finish and Material Legend".

2.03 INTERIOR STAIN AND TRANSPARENT FINISH SYSTEMS

A. Finish on Wood - Trim:
   1. 2 coat(s) varnish over 2 coat(s) stain.
   2. Stain: Semi-Transparent Stain for Wood, Solvent Based; MPI #90.
      a. Products:
         1) Pittsburgh Paints Deft Interior Oil-Based Wood Stain, DFT400 Series. (MPI #90)
         2) Sherwin-Williams Company; MW Performance Series, Interior Oil Stain..
         3) Or Equal from Approved Manufacturer.
   3. Top Coat(s): Polyurethane Varnish, Oil Modified; MPI #56 or 57.
      a. Products:
         1) Pittsburgh Paints Deft Interior Polyurethane Oil-Based 350 VOC, DFT129, Satin.
         2) Sherwin Williams Company; Minwax, Polyurethane Clear Satin.
         3) Or Equal Product from Approved Manufacturer.

2.04 ACCESSORY MATERIALS

A. Accessory Materials: Cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of finished surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.

C. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

D. Wood Surfaces to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.

3.03 APPLICATION

A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

C. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

D. Sand wood surfaces lightly between coats to achieve required finish.

E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

F. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

G. Reinstall items removed prior to finishing.

3.04 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

A. Protect finishes until completion of project.

3.06 SCHEDULE - MPI PAINT SYSTEMS

A. Substrate: Wood Trim, Interior.
   1. Stain Coats: Semi-Transparent Stain.
   2. Top Coats: Polyurethane Varnish, Satin.

END OF SECTION

SECTION 09 96 00
HIGH-PERFORMANCE COATINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. High performance coatings.

B. Surface preparation.

1.02 REFERENCE STANDARDS

A. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

B. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

C. SSPC-SP 2 - Hand Tool Cleaning; 2024.

D. SSPC-SP 3 - Power Tool Cleaning; 2024.

E. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide complete list of all products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. MPI product number (e.g. MPI #47).
   3. Cross-reference to specified coating system(s) product is to be used in; include description of each system.
   4. Manufacturer's installation instructions.

C. Samples: Submit two samples 8 by 8 inch in size illustrating colors available for selection.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

F. Maintenance Data: Include cleaning procedures and repair and patching techniques.

G. Maintenance Materials: Furnish the following for Owner / Library's use in maintenance of project.
   1. Extra Coating Materials: 1 gallon of each type and color.
   2. Label each container with manufacturer's name, product number, color number, and room names and numbers where used.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the work of this section with minimum 5 years documented experience.

1.05 MOCK-UP

A. See Section 01 40 00 - Quality Requirements, for general requirements for mock-up.

B. Provide mock-up of door frame and door, 4 feet long by 2 feet wide, illustrating coating , for each specified coating.

C. Locate where directed.

D. Mock-up may remain as part of the work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of coating, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Coating Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.07 FIELD CONDITIONS

A. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

B. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the coating product manufacturer.

C. Do not install materials when temperature is below 55 degrees F or above 90 degrees F.

D. Maintain this temperature range, 24 hours before, during, and 72 hours after installation of coating.

E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

F. Restrict traffic from area where coating is being applied or is curing.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide high performance coating products from the same manufacturer.

B. High-Performance Coatings:
   1. Tnemec Company, Inc: www.tnemec.com/#sle.
   2. Or Approved Equal.

2.02 TOP COAT MATERIALS

A. Coatings - General: Provide complete multi-coat systems formulated and recommended by manufacturer for the applications indicated, in the thicknesses indicated; number of coats specified does not include primer or filler coat.
   1. Colors: As indicated in Specification Section 09 00 00 "Finish and Material Legend".

B. Coatings - Metal
   1. Number of steps: Two
   2. Prime Coat: Series 135 Chembuild at 3.0 - 4.0 mils DFT
   3. Top Coat(s): Hybrid Aliphatic Urethane, Series 740 UVX at 3.5 - 4.5 mils
   4. Application Requirements: Spray all coats
   5. Locations:
      a. Hollow Metal Doors and Frames, Semi Gloss
      b. Primed Metal Stairs, Railing, and Guardrails
      c. Exterior metal gutter, soffit, and cornice along existing library perimeter
      d. Exterior steel lintels, Gloss
      e. Bollards, Gloss

C. Coatings - Metal
   1. Number of steps: Two
   2. Prime Coat: Series 115 Uni-Bond DF at 3.0 - 4.0 mils DFT
   3. Top Coat: Series 115 Uni-Bond DF at 3.0 - 4.0 mils DFT
   4. Locations:
      a. Interior Structural Steel where exposed to view and noted to receive paint, Eggshell
      b. Interior Metal Ducts & Electrical Raceways where exposed to view and noted to receive paint, Eggshell

D. Coatings - Gypsum Board
   1. Number of steps: Three
   2. Prime Coat: Series 151 Elasto-Grip at 1.5 - 2.5 mils DFT
   3. Intermediate Coat: Series 113 H.B. Tneme Tuffcoat at 4.5 - 6.5 mils DFT
   4. Top Coat(s): Series 113 H.B. Tneme Tuffcoat at 4.5 - 6.5 mils DFT
   5. Application Requirements: Backroll all coats to ensure a pinhole free surface.
   6. Locations:
      a. Interior Gypsum Board Walls of Bathrooms, Satin.

E. Shellac: Pure, white type.

2.03 ACCESSORY MATERIALS

A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of coated surfaces.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Do not begin application of coatings until substrates have been properly prepared.

C. Verify that substrate surfaces are ready to receive work as instructed by the coating manufacturer. Obtain and follow manufacturer's instructions for examination and testing of substrates.

D. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

E. Test shop-applied primer for compatibility with subsequent cover materials.

F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Cementitious Substrates: Do not begin application until substrate has cured 28 days minimum and measured moisture content is not greater than 12 percent.
   2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.

G. Proceed with coating application only after unacceptable conditions have been corrected.
   1. Commencing coating application constitutes Contractor's acceptance of substrates and conditions.

3.02 PREPARATION

A. Clean surfaces of loose foreign matter.

B. Remove substances that would bleed through finished coatings. If unremovable, seal surface with shellac.

C. Remove finish hardware, fixture covers, and accessories and store.

D. Existing Painted and Sealed Surfaces:
   1. Remove loose, flaking, and peeling paint. Feather edge and sand smooth edges of chipped paint.
   2. Clean with mixture of trisodium phosphate and water to remove surface grease and foreign matter.

E. Protect adjacent surfaces and materials not receiving coating from spatter and overspray; mask if necessary to provide adequate protection. Repair damage.

3.03 PRIMING

A. Apply primer to all surfaces, unless specifically not required by coating manufacturer. Apply in accordance with coating manufacturer's instructions.

3.04 COATING APPLICATION

A. Apply coatings in accordance with manufacturer's written instructions, to thicknesses specified and recommendations in "MPI Architectural Painting and Specification Manual".

B. Apply in uniform thickness coats, without runs, drips, pinholes, brush marks, or variations in color, texture, or finish. Finish edges, crevices, corners, and other changes in dimension with full coating thickness.

3.05 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

B. Clean surfaces immediately of overspray, splatter, and excess material.

C. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.

3.06 PROTECTION

A. Protect finished work from damage.

END OF SECTION

SECTION 09 96 72
FLUID-APPLIED INSULATIVE COATINGS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Section includes a spray-applied insulative coating including primer, insulative coating and topcoat for the following applications:
   1. Applied to steel penetrating the exterior envelope, from 24 inches outboard of the face of the wall to 24 inches inside the face of metal framing.

1.02 RELATED SECTIONS

A. Section 05 1200 Structural Metal Framing

B. Section 05 5000 Metal Fabrications

1.03 REFERENCES

A. American Institute of Steel Construction (AISC)
   1. AISC 303-05 Section 10 – Erection and storage of coated material during shipment and site handling shall be protected to minimize field touch up.

B. American Society of Testing and Materials (ASTM)
   1. ASTM D638 - Standard Test Method for Tensile Strength
   2. ASTM D695 - Standard Test Method for Compressive Strength
   3. ASTM D790 - Standard Test Method for Flexural Strength
   4. ASTM D4624/ISO 4624 - Standard Test Method for Bond Strength
   5. ASTM D2240 - Standard Test Method for Determining Durometer Hardness
   6. ASTM E84 - Surface Burning Characteristics
   7. ASTM C 1057 - Safe to Touch

C. Association of the American Walls and Ceilings Industries (AWCI)

D. The Society of Protective Coatings (SSPC)
   1. SSPC SP-6: Commercial Blast Cleaning Standard
   2. SSPC PA-1: Shop, Field, and Maintenance Painting of Steel.
   3. SSPC PA-2: Procedure for Determining Conformance to Dry Coating Thickness Requirements.

1.04 SYSTEM DESCRIPTION

A. The liquid applied thermal break acrylic material shall be applied at the required thickness specified by the manufacturer in order to mitigate thermal bridging. In no case shall the K-value of the liquid applied thermal break be more than 0.040 W/mK.

1.05 SUBMITTALS

A. Product Data: Submit product data including manufacturers technical data indicating product performance characteristics, performance and limitation criteria.

B. Manufacturer’s Instructions: Submit manufacturer written installation instructions.

C. Applicator Qualifications: Submit applicators current certification as a manufacturer trained applicator.

D. Performance Documentation: Submit published design listings for insulation value ratings and product thickness. Include evidence that the liquid applied thermal break testing was sponsored by the manufacturer and that the material tested was produced at the manufacturers facility under the supervision of technical personnel.

1.06 QUALITY ASSURANCE

A. Manufacturer:
   1. Company specializing in manufacturing product in this section with a minimum of 2 years documented experience in manufacturing insulative technology.

2. Applicator: Company specializing in applying the work of this section with documented experience and trained by the manufacturer.
3. Fluid Applied Thermal Break Acrylic system shall be the complete system from a sole source consisting of primer, acrylic thermal break material and topcoat.

B. Mock-up:
1. Minimum thirty days prior to application in any area, provide mock-up Samples of thermal break materials in accordance with the following requirements:
   a. Provide minimum two square feet on representative substrate, where directed by the Engineer, for each different thickness and finish of required for the work.
   b. Provide mock-up areas that comply with thickness, density application, finish texture, and color.
   c. Inspect mock-up areas within one hour of application for variance due to shrinkage, temperature, and humidity.
   d. Where shrinkage and cracking are evident, adjust mixture and method of application as necessary to meet required installation, finish, and color requirements.
   e. Continue to provide mock-up areas until acceptable areas are produced.
   f. Acceptable areas shall constitute standard of acceptance for method of application, thickness, finish texture, and color requirements, for fluid applied thermal break material applications.

1.07 DELIVERY, STORAGE AND HANDLING

A. Delivery: Deliver materials in manufacturers' original, sealed, undamaged container with identification label intact. Packaged materials shall bear the appropriate labels, seals.

B. Storage: Materials shall be stored in strict accordance with manufacturers documented instructions.

C. Documentation: All batch number, product identification and quantities shall be recorded on appropriate QC documents. A copy of the transport document and manufacturers conformance certificate shall be attached to the material delivery on site.

1.08 PROJECT/SITE CONDITIONS

A. Project Environmental Requirements: Substrate and air temperature shall be in accordance with the manufacturers' requirements.
1. Protect work area from windblown dust and rain. Protect adjacent areas from over spray of material.
2. Provide ventilation in areas to receive work of this section during application and minimum 24 hours after application.

B. Temperature and Humidity Requirements: Maintain air temperature and relative humidity in areas where products will be applied for a time period before during and after application as recommended by manufacturer.
1. Do not apply Fluid Applied Acrylic Thermal Break when temperature of substrate and/or surrounding ambient air temperature is below 45° F. Temporary protection and heat shall be maintained at this minimum temperature for 24 hours before, during and 24 hours after material application.
2. Steel substrate temperature shall be a minimum of 5° F (3° C) above the dew point of the surrounding air for a period of 24 hours prior, during the application of the material and 24 hour cure period.
3. If necessary for job schedule, the General Contractor shall provide enclosures and heat to maintain proper temperatures and humidity levels in the application areas.
4. The relative humidity of the application area shall not exceed a maximum of 85% 24 hours prior, during and 24 hours after the application of the material. The relative humidity shall not exceed 75% throughout the application and curing of the decorative top coat finish.

1.09 WARRANTY

A. Provide a manufacturer's warranty and applicators workmanship warranty.

PART 2 PRODUCTS

2.01 FLUID APPLIED INSULATION COATING GENERAL

A. Materials Compatibility:
   1. Provide shop and field primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
   2. Provide products of same manufacturer for each coat in a coating system.

2.02 MANUFACTURERS

A. Basis-of-Design: Tnemec Company Incorporated.

B. Materials specified herein shall not preclude consideration of equivalent or superior materials. Suggested equivalent materials or other substitutions shall be submitted to specifier for consideration in compliance with substitution procedures in Section 01 2500 of this Project Manual.

2.03 PRIMER

A. Zinc-Rich Aromatic Urethane:
   1. Tnemec Series 90-97 Tneme-Zinc®
      a. VOC Content: 321 grams/liter
      b. Color: 90-97 Reddish Gray
      c. Requirements:
         1) Adhesion to Steel (ASTM D4541): No less than 2,083 psi.
         2) Salt Spray (ASTM B117): No blistering, cracking or delamination of film. No more than 1/8” rust creepage at scribe and no more than 1% rusting on plane after 50,000 hours exposure.

2.04 THERMAL INSULATING COATING

A. Fluid Applied Acrylic Insulation Coating
   1. Tnemec Series 971 Aerolon Acrylic
      a. VOC Content: 1.9 grams/liter
      b. Solids by Volume: 76 percent.
      c. Colors: 1278 Insulation Yellow
      d. Requirements:
         1) Abrasion (ASTM D4060): No more than 50.2 mg loss after 1,000 cycles.
         2) Cyclic Salt Fog/UV Exposure (ASTM D5894): No blistering, cracking, rusting or delamination of film after 5,000 hours.
         3) Humidity Resistance (ASTM D4585): No blistering, cracking, rusting, or delamination after 2,000 hours.
         4) Immersion (ASTM D870): No blistering, cracking, rusting, or delamination after six months continuous tap water immersion.
         5) Surface Burning Characteristics (ASTM E84): Class A
         6) Thermal Conductivity (ASTM C518): No greater than 0.0356 W/m-°K or 0.2468 BTU-in/ft2-hr-°F.
         7) NORSOK M-501 ISO 20340: Passed 25 cycles.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. All surfaces to receive the specified Tnemec Series 971 Aerolon shall follow the manufacturer’s printed instructions and be clean, dry and free of oil, grease, loose mill scale, dirt, dust or other foreign substances which would impair bond of the material to the substrate.

D. Other corrections of the surfaces to receive the Fluid Applied Insulation Coating material shall be the responsibility of the Contractor, at no additional cost to the Owner.

E. Application of the primer, Series 971 Aerolon, and topcoat shall not commence until the contractor, applicator and inspector have examined the surfaces to receive the primer and determined the surfaces are acceptable to receive the primer and Aerolon. Commencement of application means acceptance of substrate.

F. Verify that substrate and workspace temperature and humidity conditions are in accordance with manufacturers recommendations.

3.02 SURFACE PREPARATION

A. Prepare surfaces in accordance with manufacturer's instructions.

B. Provide masking, drop cloths or other suitable coverings to prevent overspray onto surfaces not intended to be coated with thermal break coating.

C. Weld spatter and defects shall be ground smooth prior to commencement of primer and fluid applied thermal break material.

D. Primer shall not be applied to prepared substrate until the area has been adequately vented to remove all airborne dust. Prior to the application of any coating material, the blast products, dust and debris shall be removed by vacuuming.

E. Steel Substrates: Remove rust and loose mill scale.
   1. Fabrication defects:
      a. Correct steel and fabrication defects revealed by surface preparation.
      b. Remove weld spatter and slag.
      c. Round sharp edges and corners of welds to a smooth contour.
      d. Smooth weld undercuts and recesses.
      e. Grind down porous welds to pinhole-free metal.
      f. Remove weld flux from surface.
   2. Ensure surfaces are dry.
   3. Remove visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter in accordance with SSPC-SP 6/NACE 3, unless otherwise specified.

F. Abrasive Blast-Cleaned Surfaces: Coat abrasive blast-cleaned surfaces with primer before visible rust forms on surface. Do not leave blast-cleaned surfaces uncoated for more than 8 hours.
   1. Shop Primer: Prepare shop primer to receive field coat in accordance with manufacturer's instructions.

G. Concrete Surfaces (where thermal break is needed):
   1. Grind all surfaces to receive primer.
   2. Apply Series 1224 Epoxoline WB.

3.03 APPLICATION

A. Apply coatings in accordance with manufacturer's instructions.
   1. Mix and thin coatings, including multi-component materials, in accordance with manufacturer's instructions.
   2. Keep containers closed when not in use to avoid contamination.
   3. Do not use mixed coatings beyond pot life limits.
   4. Use application equipment, tools, pressure settings, and techniques in accordance with manufacturer's instructions.

B. Uniformly apply coatings at spreading rate required to achieve specified DFT.

C. Apply coatings to be free of film characteristics or defects that would adversely affect performance or appearance of coating systems.

D. Apply primer at thickness recommended by manufacturer.

E. Apply Series 971 Aerolon Thermal Insulative Coating as specified in Section 3.8 Coating Schedule.

F. Apply topcoat at thickness recommended by the manufacturer.

G. Final Dry Film Thickness (DFT) shall be measured with a dry film thickness gauge.

H. The steel deck is not to be sprayed unless otherwise indicated.

3.04 REPAIR

A. Materials and Surfaces Not Scheduled to Be Coated: Repair or replace damaged materials and surfaces not scheduled to be coated.

B. Damaged Coatings: All patching and repair to material, due to damage by other trades, shall be performed under this section and paid for by the trade responsible for the damage. Patching shall be performed by applicators certified by the manufacturer and applied in accordance with the manufacturer application instructions.

C. Coating Defects: Repair in accordance with manufacturer's instructions coatings that exhibit film characteristics or defects that would adversely affect performance or appearance of coating systems.

3.05 FIELD QUALITY CONTROL

A. The Owner will engage an independent testing laboratory inspect and verify the application of material in accordance with the provisions Tnemec Company.
   1. Material inspection and testing shall be performed 24 hours after completion of final application coat.
   2. The results of the above tests shall be made available to all parties at the completion of each pre-designated area and approval.
   3. In-place material not in compliance with the specified thickness requirements shall be corrected prior to final acceptance.

B. The dry film thickness (DFT) of the applied material shall be measured with a non-destructive coating thickness gage after material has completely cured. All measurements shall be documented in writing and furnished to the Owner.

C. Manufacturer's Technical Services: Coordinate with coating manufacturer's technical service department or independent sales representative for current technical data and instructions.

3.06 CLEANING AND PROTECTION

A. Remove overspray materials from surfaces not required to be thermally protected.

B. Protect surfaces of coating systems from damage during construction.

C. Touch-up, or repair damaged products before Substantial Completion.

3.07 ONE-YEAR INSPECTION

A. Owner will set date for one-year inspection of coating systems.

B. Inspection shall be attended by Owner, Contractor, Architect, and manufacturer's representative.

C. Repair deficiencies in coating systems as determined by Architect in accordance with manufacturer’s instructions.

3.08 LOCATIONS

A. **At thermal breaks in the building envelope including steel lintels tied back to structure, exterior cabopy steel, balcony steel, roof ladder anchorage.**

3.09 FLUID APPLIED INSULATION COATING SCHEDULE

A. Steel Members Penetrating Exterior Building Envelope:
   1. Fluid Applied Thermal Break System, Aromatic Urethane, Zinc Rich Primer.
   2. Series 971 Aerolon: A minimum of 100 mils is required for thermal break condensation control. Vary color (white/yellow) on each lift to see previous coat. Subsequent coats shall

be applied until final DFT is achieved.

a. Surface Preparation: SSPC-SP6/NACE 3
b. First Coat (Shop or Field): Series 90-97 Tneme-Zinc, DFT of 2.5 to 3.5 mils per coat.
c. Second Coat (Shop or Field): Series 971 Aerolon Acrylic, DFT of 40.0 to 50.0 mils per coat.
d. Third Coat (Shop or Field): Series 971 Aerolon Acrylic, DFT of 40.0 to 50.0 mils per coat
e. Multiple coats may be required to achieve specified 80.0 to 100.0 mils DFT for I-Beans and Flat Steel, and 160.0 to 200.0 mild DFT for tube steel.
f. Finish Coat (If exposed): Series 1071 Fluoronar, DFT of 2.0 to 3.0 mils per coat

END OF SECTION

SECTION 10 11 00
VISUAL DISPLAY UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Markerboards

B. Tackboards

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Blocking and supports.

1.03 REFERENCE STANDARDS

A. ANSI A135.4 - Basic Hardboard; 2012 (Reaffirmed 2020).

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.

C. PS 1 - Structural Plywood; 2009 (Revised 2019).

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's data on markerboard, tackboard, tackboard surface covering, trim, and accessories.

C. Shop Drawings: Indicate wall elevations, dimensions, joint locations , special anchor details.

D. Samples: Submit color charts for selection of color and texture of tackboard, tackboard surface covering, and trim.

E. Maintenance Data: Include data on regular cleaning, stain removal .

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide five year warranty for markerboard to include warranty against discoloration due to cleaning, crazing or cracking, staining, and flaking.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. ADP Lemco, Inc: www.adplemco.com/#sle.

B. ASI Visual Display Products; https://asi-visualdisplayproducts.com

C. Claridge Products and Equipment, Inc: www.claridgeproducts.com/#sle.

D. Marsh Industries: www.marsh-ind.com

E. MooreCo, Inc: www.moorecoinc.com/#sle.

F. USMarkerboard: www.usmarkerboard.com

G. Or approved equal.

2.02 VISUAL DISPLAY UNITS

A. Markerboards: Glass.
   1. Color: White.
   2. Height: 48 inches.
   3. Length: As indicated on drawings.
   4. Frame: No frame , with concealed fasteners.

5. Accessories: Provide magnetic marker tray.
6. Basis of Design: Calyx by Claridge, Connect X2 Wall-Mounted Whiteboard
7. Locations: As indicated on drawings and in Specification Section 09 00 00 Finish and Material Legend.

B. Tackboards: Composition cork.
1. Cork Thickness: 1/4 inch.
2. Color: As indicated in Specification Section 09 00 00 "Finish and Material Legend".
3. Backing: Hardboard, 1/4 inch thick, laminated to tack surface.
4. Surface Burning Characteristics: Flame spread index of 25, maximum, and smoke developed index of 450, maximum, when tested in accordance with ASTM E84.
5. Height: 48 inches.
6. Length: As indicated on drawings.
7. Frame: No frame , with concealed fasteners.
8. Basis of Design: Calyx by Claridge, Connect X2 Tack Surfaces.
9. Locations: As indicated on drawings and in Specification Section 09 00 00 Finish and Material Legend.

2.03 MATERIALS

A. Plywood: PS 1 Grade C-D , softwood.

B. Hardboard for Cores: ANSI A135.4, Class 1 - Tempered, S2S (smooth two sides).

C. Adhesives: Type used by manufacturer.

2.04 ACCESSORIES

A. Temporary Protective Cover: Sheet polyethylene, 8 mil thick.

B. Mounting Brackets: Concealed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that internal wall blocking is ready to receive work and positioning dimensions are as indicated on shop drawings.

3.02 INSTALLATION

A. Install boards in accordance with manufacturer's instructions.

B. Secure units level and plumb.

3.03 CLEANING

A. Clean board surfaces in accordance with manufacturer's instructions.

B. Cover with protective cover, taped to frame.

C. Remove temporary protective cover at Date of Substantial Completion.

END OF SECTION

SECTION 10 12 00
DISPLAY CASES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface-mounted display cases.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit complete printed data and installation details indicating products to be provided as specified.

C. Shop Drawings: Submit complete installation details. Include dimensioned elevations.

D. Specimen Warranty.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least three years of documented experience.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver display cases and materials to the Project site with manufacturer's protective crate covering and do not open until ready for use.

B. Protect display cases before, during, and after installation. In case of damage, immediately provide necessary repairs and replacements.

1.05 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty against defects and in materials, finish product and workmanship.

PART 2 PRODUCTS

2.01 DISPLAY CASES

A. Surface-Mounted Display Case: Factory-fabricated aluminum-framed display case with adjustable glass shelves, finished interior.
   1. Basis-of-Design: ASI, Bulletin Directory
      a. As indicated in Specification Section 09 00 00 Finish and Materials Legend.
   2. Width: 6 feet.
   3. Height: 4 feet.
   4. Depth: 12 inches.
   5. Components:
      a. Glazed Doors: Sliding.
         1) Number of Doors: One pair.
      b. Back Panel: Tackable.

2.02 COMPONENTS

A. Aluminum Case Construction: Aluminum side, bottom, and top panels fabricated from extruded aluminum shapes.

B. Glazed Sliding Doors:
   1. 1/4 inch clear tempered glass with plastic finger pulls.
   2. Door track: Extruded aluminum glass shoe with bottom rollers and top plastic guide.
   3. Lock: Glass door cylinder lock.

C. Tackable Back Panel: Fine-grained, homogeneous natural cork on hardboard.
   1. Cork Thickness: 1/8 inch.

2.03 MATERIALS

A. Aluminum Extrusions for Framing and Trim: Alloy as recommended by manufacturer for construction and specified finish; nominal 1/8 inch wall thickness.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Refer to drawings for display case mounting heights.

C. Clean case and glass using manufacturers recommended procedures.

3.02 ADJUSTING AND CLEANING

A. Verify that all accessories are installed as detailed for each unit.

B. At completion of work, clean glass surfaces, back panels and trim in accordance with manufacturer’s recommendations leaving units ready for use.

3.03 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

END OF SECTION

SECTION 10 14 00
SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Room and door signs.

B. Interior directional and informational signs.

C. Building identification signs.

D. Exterior monument sign lettering and enclosure.

E. Vinyl Signage.

F. Plaque.

1.02 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

B. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

C. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.

1. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
2. When content of signs is indicated to be determined later, request such information from Owner / Library through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
3. Submit for approval by Owner / Library through Architect prior to fabrication.

C. Samples: Submit one sample of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.

D. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.

E. Verification Samples: Submit samples showing colors specified.

F. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

G. Manufacturer's Qualification Statement.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.

B. Package room and door signs in sequential order of installation, labeled by floor or building.

C. Store tape adhesive at normal room temperature.

1.06 FIELD CONDITIONS

A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.

B. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Panel Signs:
   1. 2/90 Sign Systems; https://www.290signs.com
   2. ASI Signage Innovations: www.asisignage.com
   3. Best Sign Systems, Inc: www.bestsigns.com/#sle.
   4. Gemini Incorporated; https://geminimade.com/signage/
   5. Inpro: www.inprocorp.com/#sle.
   6. Mohawk Sign Systems, Inc: www.mohawksign.com/#sle.

B. Interior and Exterior Dimensional Letter Signs:
   1. A. R. K. Ramos.
   2. ASI Signage Innovations: www.asisignage.com
   3. Cosco Industries; Cast Aluminum: www.coscoarchitecturalsigns.com/#sle.
   4. Gemini Incorporated; https://geminimade.com/signage/
   5. Metal Arts; Div. of L&H Mfg. Co.

C. Plaques:
   1. ASI Signage Innovations: www.asisignage.com
   2. Best Sign Systems, Inc[<>]: www.bestsigns.com/#sle.
   3. Gemini Incorporated; https://geminimade.com/signage/
   4. Inpro; www.inprocorp.com/#sle.
   5. Mohawk Sign Systems, Inc[<>]: www.mohawksign.com/#sle.

D. Printed Vinyl Signs:
   1. 3M or Equal.

2.02 SIGNAGE APPLICATIONS

A. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.

B. Room and Door Signs **(PS-1, PS-2, PS-3, PS-6)**: Provide a sign for every doorway, whether it has a door or not, not including corridors, lobbies, and similar open areas.
   1. Sign Type: Flat signs with applied character panel media as specified.
   2. Provide "tactile" signage, with letters raised minimum 1/32 inch and Grade II braille.
   3. Character Height: 1 inch or as indicated on the drawings.
   4. Colors to be selected from manufacturer's standard colors.
   5. Provide 2 additional signs of type PS-1, PS-6.
   6. Where signage will be mounted on glass, provide blank panel on back of glass to hide adhesive.

C. Interior Directional and Informational Signs **(PS-4, PS-5)**:
   1. Sign Type: Flat signs raised character media as specified.
   2. Sizes: As indicated on drawings.
   3. Where suspended, ceiling mounted, or projecting from wall signs are indicated, provide two-sided signs with same information on both sides.

D. Building Identification Signs:
   1. Use individual metal letters.
   2. Mount on outside wall in locations indicated on drawings.

E. Dedication Plaque: See Drawings for Location and for details.

2.03 SIGN TYPES

A. Flat Signs: Signage media without frame.
   1. Edges: Square.
   2. Corners: Square.

3. Wall Mounting of One-Sided Signs: Tape adhesive.
4. Wall Mounting on glass: Tape adhesive with backup, cover sign on opposite side of glass. Backup cover sign to be same color as main front sign panel.
5. Wall and Ceiling Mounting of Two-Sided Signs: Aluminum wall bracket, powder coated, color selected from manufacturer's standard colors, attached with screws in predrilled mounting holes, set in clear silicone sealant.
6. Suspended Mounting: Stainless steel suspension cables, cable clamps, and ceiling fastener suitable for attachment to ceiling construction indicated.

B. Color and Font: Unless otherwise indicated:
1. Character Font: Helvetica, Arial, or other sans serif font. Selected from manufacturer's full range.
2. Character Case: Upper case only, as scheduled.
3. Background Color: As scheduled.
4. Character Color: Contrasting color.

2.04 TACTILE SIGNAGE MEDIA

A. Injection Molded Panels: One-piece acrylic plastic, with raised letters and braille.
1. Total Thickness: 1/8 inch.

2.05 NON-TACTILE SIGNAGE MEDIA

A. Vinyl Lettering **(VL)**:
1. See schedule for Heights.
2. Mounting Method: Pressure sensitive adhesive
3. See sign schedule for locations and dimensions.

B. Printed Window Graphic Film **(V)**:
1. Pressure Sensitive Adhesive.
2. Fill glazing surface identified on schedule, image to be selected at a later date.

2.06 PLAQUES

A. Metal Plaques:
1. Metal: Aluminum casting.
2. Metal Thickness: 1/4 inch 1/2 inch, minimum.
3. Size: As indicated on drawings.
4. Text and Typeface:
   a. Character Font: As selected from manufacturer's full range.
   b. Text: The owner will finalize the wording on the plaque upon shop drawing submittal.
   c. Character Color: Contrast with background color.
5. Border Style: As selected by Architect from manufacturer's standard borders.
6. Background Texture: Pebble.
7. Surface Finish: Brushed, satin.
8. Painted Background Color: As selected by Architect from manufacturer's standard background colors.
9. Protective Coating: Manufacturer's standard clear coating.
10. Mounting: Blind studs.

2.07 DIMENSIONAL LETTERS

A. Metal Letters - Interior:
1. Type: INTERIOR DIMENSIONAL LETTER SIGNAGE
2. Metal: Aluminum casting.
3. Metal Thickness: 1/8 inch minimum.
4. Letter Height: As indicated on signage schedule.
5. Text and Typeface:
   a. Character Font: As selected from manufacturer's full range of letters, to fit in width dimension provided.

b. Character Case: Upper case only.
6. Finish: As selected by Architect from manufacturer's full range of Color Anodized.
7. Mounting: Concealed screws.

B. Metal Letters - Exterior:
1. Type: EXTERIOR DIMENSIONAL LETTER SIGNAGE
2. Metal: Aluminum casting.
3. Metal Thickness: 1 inch minimum.
4. Letter Height: As indicated on signage schedule.
5. Text and Typeface:
a. Character Font: As selected from manufacturer's full range of letters, to fit in width dimension provided.
b. Character Case: Upper case only.
6. Finish: As selected by Architect from manufacturer's full range of Color Anodized.
7. Mounting: Projected Spacer Mount.

C. Metal Letters - Exterior:
1. Type: EXTERIOR MONUMENT SIGN LETTERS AND ENCLOSURE
2. Material: 1/2" thick push through acrylic letters and aluminum cabinet.
3. Cabinet: 1" square aluminum tube frame with .063 aluminum sides.
4. Cabinet Size: 21” high x 103” wide x 12” deep to cap message center.
5. Letter Height: As indicated on building drawings
6. Text and Typeface:
a. Character Font: As selected from manufacturer's full range of letters, to fit in width dimension provided.
b. Character Case: Upper case only.
7. Finish: As selected by Architect from manufacturer's full range of acrylic.
8. Mounting: Copy routed from the aluminum face and backed with ½” thick push thru acrylic letters. The letters will be faced with translucent vinyl.

2.08 ACCESSORIES

A. Concealed Screws: Stainless steel, galvanized steel, chrome plated, or other non-corroding metal.

B. Tape Adhesive: Double sided tape, permanent adhesive.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install neatly, with horizontal edges level.

C. Locate signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.

D. Protect from damage until Date of Substantial Completion; repair or replace damaged items.

SCHEDULE

SIGNAGE TYPES AND LOCATIONS

RM # (PLAN)	RM NAME (PLAN)	SIGN TYPE	SIGN COPY	SIGN TRANSLATION	QTY	COMMENTS
	(EXTERIOR)		(PROJECT SIGN)		1	PROJECT SIGN, 96"W X 48"H

	(EXTERIOR)		DELAVAN PUBLIC LIBRARY			MONUMENT SIGN
100	VESTIBULE	DL	DELAVAN PUBLIC LIBRARY		1	18"H METAL LETTERING (EXTERIOR), SERIF
100	VESTIBULE	D-1			1	DEDICATION PLAQUE
100	VESTIBULE	VL			1	NORTH WALL, APPROX. 9'-2"W X 9'-0"HDONOR WALL GRAPHIC TO BE PROVIDED BY LIBRARY
100	VESTIBULE	VL			1	SOUTH WALL, APPROX. 9'-2"W X 9'-0"HDONOR WALL GRAPHIC TO BE PROVIDED BY LIBRARY
100	VESTIBULE	VL			1	WEST WALL, APPROX. 12'-0"W X 9'-0"HDONOR WALL GRAPHIC TO BE PROVIDED BY LIBRARY
101	MENS	PS-2	MEN	HOMBRES	1	PICTOGRAM - ADA TOILET
102	FAMILY	PS-2	FAMILY	BAÑO FAMILIAR	1	PICTOGRAM - ADA FAMILY TOILET
103	WOMENS	PS-2	WOMEN	MUJERES	1	PICTOGRAM - ADA TOILET
105	B.R.	PS-1	BOOK DROP		1	
105	B.R.	PS-1	RETURN	BUZÓN DE DEVOLUCIÓN	1	EXTERIOR
106	KIT. STOR.	PS-1	STORAGE	ALMACÉN	1	
108	STORAGE	PS-1	STORAGE	ALMACÉN	1	
109	MEETING ROOM	PS-1	MEETING ROOM	SALA DE REUNIONES	1	
109	MEETING ROOM	PS-1	EXIT ONLY	SOLO SALIDA	1	
109	MEETING ROOM	PS-1	MAXIMUM OCCUPANCY ###		1	

110	STORYTIME	PS-1	STORYTIME	HORA DEL CUENTO	1	*
111	LOBBY	PS-1	MAXIMUM OCCUPANCY ###		2	
112	VESTIBULE	DL	DELAVAN PUBLIC LIBRARY		1	18"H METAL LETTERING (EXTERIOR), SERIF
112	VESTIBULE	PS-5	AFTER HOURS PICKUP		1	SUSPENDED SIGN
113	STUDY	PS-1	STUDY ROOM 1	SALA DE ESTUDIO 1	1	
113	STUDY	PS-6			1	PAPER INSERT
113	STUDY	VL	1		1	24"H VINYL LETTERING
113	STUDY	VL	CONTACT STAFF FOR USE	CONTACTE AL PERSONAL PARA SU USO	1	1"H VINYL LETTERING
114	STUDY	PS-1	STUDY ROOM 2	SALA DE ESTUDIO 2	1	
114	STUDY	PS-6			1	PAPER INSERT
114	STUDY	VL	2			24"H VINYL LETTERING
114	STUDY	VL	CONTACT STAFF FOR USE	CONTACTE AL PERSONAL PARA SU USO	1	1"H VINYL LETTERING
115	NONFICTION - ADULT READING	PS-5	NONFICTION	NO FICCIÓN	1	** SUSPENDED SIGN
115	NONFICTION - ADULT READING	PS-5	LARGE PRINT	LETRA GRANDE	1	** SUSPENDED SIGN
116	CIRCULATION	VL			1	EAST WALL, APPROX. 44'-7"W X 3'-4"HWOMEN WITH WORDS GRAPHIC TO BE PROVIDED BY LIBRARY
117	CIRC. DESK	DL	ASK		1	12"H METAL LETTERING
117	CIRC. DESK	DL	PREGUNTAR		1	6"H METAL LETTERING
118	HOLDS	PS-5	HOLDS	LIBROS RETENIDOS	1	** SUSPENDED SIGN
119	STAFF WORKROOM	PS-1	STAFF WORKROOM	ÁREA DE TRABAJO DEL PERSONAL	1	

119	STAFF WORKROOM	PS-1	STAFF ONLY	SOLO PERSONAL	2	
121	DIRECTOR	PS-3	OFFICE	OFICINA	1	* PAPER INSERT
122	LIBRARIAN	PS-3	OFFICE	OFICINA	1	* PAPER INSERT
123	ASSIST.DIR	PS-3	OFFICE	OFICINA	1	* PAPER INSERT
124	SENSORY	PS-1	SENSORY ROOM	SALA SENSORIAL	1	
125	STAFF RR	PS-2	STAFF	PERSONAL	1	PICTOGRAM - ADA TOILET
126	TOILET	PS-2	FAMILY	BAÑO FAMILIAR	1	PICTOGRAM - ADA FAMILY TOILET
127	STUDY	PS-1	STUDY ROOM 3	SALA DE ESTUDIO 3	1	
127	STUDY	PS-6			1	PAPER INSERT
127	STUDY	VL	3			24"H VINYL LETTERING
127	STUDY	VL	CONTACT STAFF FOR USE	CONTACTE AL PERSONAL PARA SU USO	1	1"H VINYL LETTERING
128	STUDY	PS-1	STUDY ROOM 4	SALA DE ESTUDIO 4	1	
128	STUDY	PS-6			1	PAPER INSERT
128	STUDY	VL	4			24"H VINYL LETTERING
128	STUDY	VL	CONTACT STAFF FOR USE	CONTACTE AL PERSONAL PARA SU USO	1	1"H VINYL LETTERING
130	IT	PS-1	IT	SISTEMAS	1	
135	DISCOVER ZONE	DL	DISCOVER		1	12"H METAL LETTERING, RAIL MOUNTED
135	DISCOVER ZONE	DL	ZONE		1	12"H METAL LETTERING, RAIL MOUNTED
135	DISCOVER ZONE	DL	ZONA DE DESCUBRIMIENTO		1	6"H METAL LETTERING
138	MAKERSPACE	PS-1	MAKERSPACE	ESPACIO CREATIVO	1	*
138	MAKERSPACE	VL	MAKERSPACE		1	12"H VINYL LETTERING
138	MAKERSPACE	VL			1	WEST WALL, APPROX. 22'-8"W X 9'-0"H
138	MAKERSPACE	VL			1	SOUTH WALL, APPROX. 16'-6"W X 9'-0"H

139	STOR.	PS-1	STORAGE	ALMACÉN	1	
140	FICTION - ADULT BROWSING	PS-5	FICTION	FICCIÓN	1	** SUSPENDED SIGN
142	TEEN COLLECTION					NEON SIGNAGE - BY OWNER
142	TEEN COLLECTION	VL			1	EAST WALL, APPROX. 15'-3"W X 9'-0"H
143	TEEN	PS-1	TEEN SPACE	ESPACIO ADOLESCENTE	1	*
143	TEEN	VL			1	EAST WALL, APPROX. 24'W X 9'-0"H
144	MECH. ROOM	PS-1	MECHANICAL	CUARTO DE MÁQUINAS	1	
146	STAIRS	PS-2	STAIRS	ESCALERAS	1	PICTOGRAM - STAIRS
147	STAIRS	PS-2	STAIRS	ESCALERAS	1	PICTOGRAM - STAIRS
149	ELEV.	PS-2	ELEVATOR	ELEVADOR	2	(1) AT EACH LEVEL, PICTOGRAM - ELEVATOR
150	STAIRS	PS-2	STAIRS	ESCALERAS	1	PICTOGRAM - STAIRS
151	BOILER ROOM	PS-1	MECHANICAL	CUARTO DE MÁQUINAS	1	
152	AIR HANDLER ROOM	PS-1	MECHANICAL	CUARTO DE MÁQUINAS	1	
153	STORAGE	PS-1	STORAGE	ALMACÉN	1	
154	TECHNICAL SERVICES	PS-1	TECHNICAL SERVICES	PROCESOS TÉCNICOS	1	
156	CANTEEN	PS-1	CANTEEN	COMEDOR	1	
156	CANTEEN	PS-4	CANTEEN		1	
157	TECH. SERVICES STOR.	PS-1	STORAGE	ALMACÉN	1	
158	GENDER NEUTRAL TOILET	PS-1	FAMILY	BAÑO FAMILIAR	1	PICTOGRAM - ADA TOILET
159	TOILET	PS-1	GENDER NEUTRAL	BAÑO NEUTRO	1	PICTOGRAM - ADA TOILET
160	CORRIDOR	PS-1	STAFF ONLY	SOLO PERSONAL	1	
161	JAN.	PS-1	CUSTODIAL	CONSERJE	1	
162	BOILER	PS-1	MECHANICAL	CUARTO DE MÁQUINAS	1	
163	MAINT.	PS-1	MAINTENANCE	MANTENIMIENTO	1	

164	RECORDS STORAGE	PS-1	STORAGE	ALMACÉN	2	
165	STAIRS	PS-1	STAFF ONLY	SOLO PERSONAL	1	MOUNTED ON INTERIOR SIDE OF EXISTING DOOR
166	FRIENDS	PS-1	FRIENDS OF THE LIBRARY	AMIGOS DE LA BIBLIOTECA	1	
167	STOR.	PS-1	STORAGE	ALMACÉN	1	
169	STOR.	PS-1	STORAGE	ALMACÉN	1	
170	STOR.	PS-1	STORAGE	ALMACÉN	1	
171	STOR.	PS-1	STORAGE	ALMACÉN	1	
172	STAFF BREAKROOM	PS-1	STAFF BREAKROOM	SALA DE EMPLEADOS	1	
174	YOUTH STORAGE	PS-1	YOUTH SERVICES WORKROOM	ÁREA DE TRABAJO DE SERVICIOS JUVENILES	1	
202	STOR.	PS-1	STORAGE	ALMACÉN	1	
204	OFFICE	PS-3	OFFICE	OFICINA	1	* PAPER INERT
206	STOR.	PS-1	STORAGE	ALMACÉN	1	
246	STAIR	PS-2	STAIRS	ESCALERAS	1	PICTOGRAM - STAIRS
265	STAIR	PS-2	STAIRS	ESCALERAS	1	PICTOGRAM - STAIRS

GENERAL NOTES: - SEE DRAWINGS FOR ELEVATIONS AND DETAILS - GRAPHICS AND ROOM NAMES ARE TO BE VERIFIED BY THE OWNER IN SHOP DRAWINGS - ROOM IDENTIFICATION SIGNS AND 'CONTACT STAFF' LETTERING ARE TO INCLUDE SIGN COPY IN BOTH ENGLISH AND SPANISH (SEE SIGN TRANSLATION COLUMN)* INDICATES SIGN IS TO HAVE A BLANK BACK PANEL PROVIDED INDICATES SIGN IS TO BE DOUBLE SIDED**

END OF SECTION

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SECTION 10 15 00
VIDEO DISPLAY SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Panelized LED video display message center.

1.02 RELATED REQUIREMENTS

A. Section 05 50 00 - Metal Fabrications: Support structure.

B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

C. Section 26 05 33.13 - Conduit for Electrical Systems.

1.03 REFERENCE STANDARDS

A. ANSI/Infocomm 10 - Audiovisual Systems Performance Verification; 2013.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting two weeks prior to the start of the work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's data sheets on panelized LED display systems including recommendations for preparation, storage and handling, and installation.

C. Shop Drawings: Indicate cable routing, connections between equipment, anchor and support details, and adjacent construction.

D. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

E. Project Record Documents: Provide quantities, type, and location for components, cabling and accessories.

F. System Setting Backup: Provide an electronic file of all system settings.

G. Security Items:
   1. Provide one set of keys for each locked equipment enclosure.
   2. Provide passwords to access control functions for hardware and software user interfaces.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Authorized Manufacturer Representative: System shall be configured and commissioned by an authorized manufacturer representative.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in compliance with manufacturer instructions.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide six year manufacturer warranty for the message center.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Watchfire, 10mm Color Slim Front Ventilation Highbrightness LED WatchFire Message Center

B. Or Approved Equal.

2.02 PANELIZED LED VIDEO DISPLAY MESSAGE CENTER

A. Performance Requirements:

1. Comply with performance standards based on tests conducted in accordance with ANSI/Infocomm 10.

B. System Type: Flat, two units to create double-sided look at sign.
1. Matrix: 90 X 210
2. Color: LED RGB
3. Software: Watchfire "Ignite OP".
4. Display Capability: 1.2 Quintillion
5. Horizontal Viewing Angle: 150 Degrees.
6. Vertical Viewing Angle: 95 Degrees.
7. Brightness: Daytime 7,000 NITs Maximum / Nighttime 700 NITs Maximum adjustable
8. Mount Type: Outdoor mount on steel frame / masonry enclosure.
9. Location: Outdoor.
10. Total Height: 3 ft, 5 inches.
11. Total Length: 7 ft, 3 inches.
12. Video: Plays prerecorded clips 30FPS, Animated Text & Graphics
13. Temp Sensor: Included

2.03 CONTROLS

A. Interface Unit:
1. Working Voltage: 120 volt, 26.0 amp, single phase. As coordinated with Electrical.
2. Communication: 4G Wireless with Life of Sign Data Plan

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrates and support structure is in place and properly prepared.

B. Verify that required power and data sources are provided.

C. Verify that space is available for centrally located components.

D. Notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Prepare substrates using the methods recommended by the manufacturer for achieving the best result under the project conditions.

B. Do not proceed with installation until support structure and substrates have been prepared using the methods recommended by the manufacturer and deviations from manufacturer's recommended tolerances are corrected. Commencement of installation constitutes acceptance of conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions .

B. Install message center and signs level and plumb with fasteners reccommended by the manufacturer.

C. Custom Mounting: Coordinate with support structure specified in 05 50 00 and indicated on drawings for mounting and support.

D. Record any necessary changes to the system design.

3.04 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

B. See Section 01 79 00 - Demonstration and Training, for additional requirements.

C. Demonstrate proper operation and maintenance of equipment to Owner / Library's designated representative. Provide up to 4 hours of sign programming/operation instruction

D. Review service and support contacts.

3.05 PROTECTION

A. Protect installed products from subsequent construction operations.

END OF SECTION

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SECTION 10 21 13.19
PLASTIC TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Solid plastic toilet compartments.

B. Urinal screens.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Blocking and supports.

B. Section 10 28 00 - Toilet and Bath Accessories.

1.03 REFERENCE STANDARDS

A. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2019.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the work with placement of support framing and anchors in walls and ceilings.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on panel construction, hardware, and accessories.

C. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.

D. Samples: Submit two samples of partition panels, 6 by 6 inch in size illustrating panel finish, color, and sheen.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Solid Plastic Toilet Compartments:
   1. Accurate Partitions Corporation: www.accuratepartitions.com
   2. ASI - Global Partitions: www.globalpartitions.com
   3. Bobrick Washroom Equipment: www.bobrick.com
   4. Bradley Corporation: www.bradleycorp.com
   5. General Partitions: www.generalpartitions.com
   6. Inpro: www.inprocorp.com/#sle.
   7. Scranton Products: www.scrantonproducts.com/#sle.
   8. Or approved equal.

2.02 PLASTIC TOILET COMPARTMENTS

A. Solid Plastic Toilet Compartments: Factory fabricated doors, pilasters, and divider panels made of solid molded high density polyethylene (HDPE), tested in accordance with NFPA 286; Floor Mounted-Overhead Braced.
   1. Color: As identified in Specification Section 09 00 00 "Finish and Material Legend".
   2. Doors:
      a. Thickness: 1 inch.
      b. Width: 30 inch.
      c. Width for Handicapped Use: 36 inch, out-swinging.
      d. Height: 55 inch.
   3. Panels:
      a. Thickness: 1 inch.
      b. Height: 55 inch.

4. Pilasters:
   a. Thickness: 1 inch.
   b. Width: As required to fit space; minimum 3 inch.
5. Urinal Screens: Without doors; to match compartments; mounted to wall with continuous panel brackets.

2.03 ACCESSORIES

A. Head Rails: Extruded aluminum, anti-grip profile.
   1. Size: Manufacturer's standard size.

B. Wall and Pilaster Brackets: Anodized aluminum; continuous type.

C. Attachments, Screws, and Bolts: Stainless steel , tamper proof type.
   1. For attaching panels and pilasters to brackets: Through-bolts and nuts ; tamper proof.
   2. For concealed anchors, use stainless steel compatible with related materials.

D. Hinges: Stainless steel; satin finish.
   1. Continuous-type hinge, self closing.
      a. Manufacturer's minimum 0.062-inch- thick stainless-steel continuous, cam type that swings to a closed or partially open position, allowing emergency access by lifting door. Mount with through-bolts

E. Door Hardware: Stainless steel; satin finish.
   1. Door Latch: Slide type with exterior emergency access feature.
      a. Latch and Keeper: Manufacturer's heavy-duty surface-mounted cast-stainless-steel latch unit designed to resist damage due to slamming, with combination rubber-faced door strike and keeper, and with provision for emergency access. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible. Mount with through-bolts.
   2. Provide door pull for outswinging doors.
      a. Manufacturer's heavy-duty cast-stainless-steel pull at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible. Mount with through-bolts.

F. Coat Hook: One per compartment, mounted on door.
   1. Manufacturer's heavy-duty combination cast-stainless-steel hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories. Mount with through-bolts.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify correct spacing of and between plumbing fixtures.

C. Verify correct location of built-in framing, anchorage, and bracing.

3.02 INSTALLATION

A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.

B. Maintain 3/8 inch to 1/2 inch space between wall and panels and between wall and end pilasters.

C. Attach panel brackets securely to walls using anchor devices.

D. Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.

E. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.

F. Field touch-up of scratches or damaged finish will not be permitted. Replace damaged or scratched materials with new materials.

G. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

3.03 TOLERANCES

A. Maximum Variation From True Position: 1/4 inch.

B. Maximum Variation From Plumb: 1/8 inch.

3.04 ADJUSTING

A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.

B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.

C. Adjust adjacent components for consistency of line or plane.

END OF SECTION

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SECTION 10 22 39
FOLDING PANEL PARTITIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Top-supported folding panel partitions, horizontal opening.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Wood blocking and track support shimming.

1.03 REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard; 2016.

B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2020.

C. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.

E. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).

F. ASTM E413 - Classification for Rating Sound Insulation; 2016.

G. ASTM E557 - Standard Guide for Architectural Design and Installation Practices for Sound Isolation Between Spaces Separated by Operable Partitions; 2012 (Reapproved 2020).

H. ASTM F793/F793M - Standard Classification of Wall Coverings by Use Characteristics; 2020.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene at project site seven calendar days prior to scheduled beginning of construction activities of this section to review section requirements.
   1. Require attendance by representatives of installer.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on partition materials, operation, hardware and accessories, electric operating components, track switching components, and colors and finishes available.

C. Design Data: Design calculations, bearing seal and signature of structural engineer licensed to practice in the State in which the Project is located, showing loads at points of attachment to the building structure.

D. Shop Drawings: Indicate opening sizes, track layout, details of track and required supports, static and dynamic loads, location and details of pass door and frame, adjacent construction and finish trim, and stacking depth.

E. Samples for Selection: Submit two samples of full manufacturer's color range for selection of colors.

F. Samples for Review: Submit two samples of surface finish, 12 by 12 inches size, illustrating quality, colors selected, texture, and weight.

G. Certificates: Certify that partition system meets or exceeds specified acoustic requirements.

H. Manufacturer's Instructions: Indicate special procedures.

I. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods. Describe cleaning materials detrimental to finish surfaces and hardware finish.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until installation.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within five year period after Date of Substantial Completion.

C. Provide two year manufacturer warranty against defects in material and workmanship, excluding abuse.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Folding Panel Partitions - Horizontal Opening:
   1. Corflex Movable Partitions: https://corflex.ca/en/
   2. Moderco, Inc: www.moderco.com/#sle.
   3. Modernfold, a DORMA Group Company: www.modernfold.com/#sle.
   4. Panelfold, Inc: www.panelfold.com/#sle.
   5. Or Approved Equal.

2.02 FOLDING PANEL PARTITIONS - HORIZONTAL OPENING

A. Folding Panel Partitions: Side opening; individual panels; side stacking; manually operated.

B. Basis of Design: Acousti-Seal Premier - Single Panel

C. Panel Construction:
   1. Frame: 16 gauge, 0.0598 inch thick formed sheet steel frame top, bottom, jambs, and intermediates; welded construction, with acoustical insulation fill.
   2. Substrate: Medium-density fiberboard.
   3. Panel Substrate Facing: Steel sheet, 20 gauge, 0.0359 inch thickness.
   4. Panel Properties:
      a. Thickness With Finish: Not less than 3 inches.
      b. Width: Up to 48 inches (1219 mm).
      c. Weight: 8 lb/sq ft.

D. Panel Finishes:
   1. Facing: Vinyl coated fabric selected from Manuracturer's standard range of options.
   2. Exposed Metal Trim: As selected from manufacturers' standard range of colors.

E. Panel Seals:
   1. Panel to Panel Seals: Grooved and gasketed astragals, with continuous flexible ribbed vinyl seal fitted to panel edge construction; color to match panel finish.
   2. Acoustic Seals: Flexible acoustic seals at jambs, ceilings, retractable floor seals, and above track to structure acoustic seal.
   3. Vertical Seals Basis of Design: Modernfold, AS-34.
   4. **Confirm seal depth to work with wood base.**

F. Suspension System:
   1. Track: Formed steel; 1-5/8 by 1-5/8 inch size; thickness and profile designed to support loads, steel sub-channel and track connectors, and track switches.
   2. Carriers: Steel, ball bearing wheels on trolley carrier at top of every individual panel, sized to carry imposed loads, with threaded pendant bolt for vertical adjustment.

3. Basis of Design: Modernfold RT100 Suspension System – Right Angle Turn.

G. Performance:
1. Acoustic Performance:
a. Sound Transmission Class (STC): 50 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90, on panel size of 100 sq ft.
2. Surface Burning Characteristics of Panel Finish: Flame spread/smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84.
3. Installed partition system track capable of supporting imposed loads, with maximum deflection of 1/360 of span.

2.03 MATERIALS

A. Aluminum Extrusions: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.

B. Vinyl Coated Fabric: ASTM F793 Category VI, polyvinyl fluoride (PVC) finish for washability and improved flame retardance; color as selected by Architect from manufacturer's standard range.

C. Particleboard: ANSI A208.1; composed of wood chips, sawdust, or flakes of medium density, made with waterproof resin binders; of grade to suit application; sanded faces.

D. Acoustic Insulation:
1. Type: As required for acoustic performance indicated.
2. Thickness: As required for acoustic performance indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that required utilities are available, of the correct characteristics, in proper location, and ready for use.

C. Verify track supports are laterally braced and will permit track to be level within 1/4 inch of required position and parallel to the floor surface.

3.02 INSTALLATION

A. Install partition in accordance with manufacturer's instructions and ASTM E557.

B. Install electric operator, wiring, and controls. Locate control station(s) as indicated.

C. Install acoustic sealant to achieve required acoustic performance.

D. Coordinate electrical connections.

3.03 ADJUSTING

A. Adjust partition assembly to provide smooth operation from stacked to full open position. Do not over-compress acoustic seals.

B. Visually inspect partition in full extended position for light leaks to identify a potential acoustical leak.

C. Adjust partition assembly to achieve lightproof seal.

3.04 CLEANING

A. Clean finish surfaces and partition accessories.

3.05 CLOSEOUT ACTIVITIES

A. Demonstrate operation of partition and identify potential operational problems.

END OF SECTION

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SECTION 10 26 00
WALL AND DOOR PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Corner guards.

B. Protective wall covering.

1.02 REFERENCE STANDARDS

A. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2010 (Reapproved 2018).

B. ASTM D543 - Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents; 2020.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.

D. ASTM F476 - Standard Test Methods for Security of Swinging Door Assemblies; 2014.

E. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Indicate physical dimensions, features, anchorage details, and rough-in measurements.

C. Samples: Submit samples illustrating component design, configurations, joinery, color and finish.

D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner / Library's name and registered with manufacturer.

E. Maintenance Materials: Furnish the following for Owner / Library's use in maintenance of project:
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Stock Materials: 20 square feet of each kind of protective wall covering.

F. Maintenance Data: Manufacturer's instructions for care and cleaning of each type of product. Include information about both recommended and potentially detrimental cleaning materials and methods.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver products to project site until areas for storage and installation are fully enclosed, and interior temperature and humidity are in compliance with manufacturer's recommendations for each type of item.

1.05 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a one year period after Date of Substantial Completion.

C. Provide five year manufacturer and installer warranty for metal crash rails.
   1. Failures include, but are not limited to, the following:
      a. Structural failures, internal connection failures, and/or detachment of rail system from substrates.
      b. Deterioration of materials beyond that expected of normal use, as intended by manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Corner Guards:
   1. Construction Specialties, Inc: www.c-sgroup.com/#sle.
   2. Inpro: www.inprocorp.com/#sle.
   3. Or Approved Equal.

B. Protective Wall Covering:
   1. Construction Specialties, Inc; Acrovyn High-Impact Wall Covering: www.c-sgroup.com/#sle.
   2. Inpro; Palladium Rigid Sheet Wall Protection: www.inprocorp.com/#sle.
   3. Or Approved Manufacturer.

2.02 PERFORMANCE CRITERIA

A. Impact Strength: Unless otherwise noted, provide protection products and assemblies that have been successfully tested for compliance with applicable provisions of ASTM D256 and/or ASTM F476.

B. Chemical and Stain Resistance: Unless otherwise noted, provide protection products and assemblies with chemical and stain resistance complying with applicable provisions of ASTM D543.

C. Fungal Resistance: Unless otherwise noted, provide protection products and assemblies which pass ASTM G21 testing.

2.03 PRODUCT TYPES

A. Corner Guards - Surface Mounted:
   1. Basis of Design: Inpro 160 High Impact Corner Guard.
   2. Material: PVC Plastic, acrylic-modified vonyl sheet, or opaque polycarbonate sheet.
   3. Width of Wings: 2 inches.
   4. Corner: Square.
   5. Color: As selected from manufacturer's standard colors.
   6. Length: One piece.

B. Protective Wall Covering:
   1. Material: Polyethylene terephthalate (PET or PETG); PVC and PBTs-free.
   2. Thickness: 0.060 inch.
   3. Surface Burning Characteristics: Provide assemblies with flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
   4. Color: As indicated in Specification Section 09 00 00 "Finish and Material Legend".
   5. Texture: Pebble.
   6. Height: 48 inches nominal.
   7. Accessories: Provide manufacturer's standard color-matched trim and moldings.
      a. Inside Corner Trim: Standard angle
      b. Outside Corner Trim: Standard angle.
   8. Mounting: Adhesive.
   9. Locations: As indicated on the Finish and Materials Legend.

C. Adhesives and Primers: As recommended by manufacturer.

2.04 FABRICATION

A. Fabricate components with tight joints, corners and seams.

2.05 SOURCE QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Provide wall protection systems of each type from a single source and manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.

B. Verify that field measurements are as indicated on drawings.

C. Verify that substrate surfaces for adhered items are clean and smooth.

3.02 INSTALLATION

A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.

B. Position corner guard 4 inches above finished floor to 48 inches high.

C. Position protective wall covering no less than 1 inch above finished floor to allow for floor level variation.

1. Wainscot Installation: Establish a level line at the specified height for entire length of run. Install by aligning top of edge of covering with this line.
2. Apply adhesive with 1/8 inch V-notch trowel to an area of wall surface that can be completed within cure time of the adhesive.
3. Install trim pieces as required for a complete installation. Allow tolerance for thermal movement.
4. At inside and outside corners cut covering sheets to facilitate installation of trim pieces or corner guards.

3.03 TOLERANCES

A. Maximum Variation From Required Height: 1/4 inch.

B. Maximum Variation From Level or Plane For Visible Length: 1/4 inch.

3.04 CLEANING

A. Clean wall and door protection items of excess adhesive, dust, dirt, and other contaminants.

END OF SECTION

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SECTION 10 28 00
TOILET AND BATH ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Commercial toilet accessories.

B. Electric hand/hair dryers.

C. Diaper changing stations.

D. Utility room accessories.

1.02 RELATED REQUIREMENTS

A. Section 08 83 00 - Mirrors: Other mirrors.

B. Section 22 40 00 - Plumbing Fixtures: Under-lavatory pipe and supply covers.

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.

C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

D. ASTM C1036 - Standard Specification for Flat Glass; 2016.

E. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2018.

F. ASTM F2285 - Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use; 2004, with Editorial Revision (2016).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Commercial Toilet and Bath Accessories:
   1. AJW Architectural Products: www.ajw.com/#sle.
   2. American Specialties, Inc: www.americanspecialties.com/#sle.
   3. Bobrick Corporation: www.bobrick.com
   4. Bradley Corporation: www.bradleycorp.com/#sle.
   5. Or approved equal.

B. Diaper Changing Stations:
   1. Bradley Corporation: www.bradleycorp.com/#sle.
   2. Koala Kare Products: www.koalabear.com/#sle.
   3. Or Approved Equal.

2.02 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
   1. Grind welded joints smooth.
   2. Fabricate units made of metal sheet of seamless sheets with flat surfaces.

B. Keys: Provide 2 keys for each accessory to Owner / Library; master key lockable accessories.

C. Stainless Steel Sheet: ASTM A666, Type 304.

D. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

E. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.

F. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.

2.03 FINISHES

A. Stainless Steel: Satin finish, unless otherwise noted.

B. Galvanizing for Items Other than Sheet: Comply with ASTM A123/A123M; galvanize ferrous metal and fastening devices.

2.04 COMMERCIAL TOILET ACCESSORIES

A. Toilet Paper Dispenser **(TP)**: Roll-in-reserve type, designed to allow automatic activation of reserve roll when needed, or manual activation by pressing release bar, surface-mounted, stainless steel unit with pivot hinge, tumbler lock.
   1. Products:
      a. Basis of Design: Bobrick B-4288.

B. Paper Towel Dispenser: Battery Operated, Automatic Universal Roll Paper Towel Dispenser .
   1. Cover: Stainless steel.
   2. Paper Discharge: Touchless automatic.
   3. Capacity: 8 inch diameter roll.
   4. Mounting: Surface mounted.
   5. Power: Battery operated.
   6. Refill Indicator: Illuminated refill indicator.
   7. Products:
      a. Basis-of-Design: Bobrick B-2974.

C. Combination Towel Dispenser/Waste Receptacle **(TD/WR)**: Semi-recessed with projecting waste receptacle, stainless steel; seamless wall flanges, continuous piano hinges.
   1. Waste receptacle liner: Reusable, heavy-duty vinyl.
   2. Towel dispenser capacity: Automatic Roll.
   3. Waste receptacle capacity: 18 gallons.
   4. Products:
      a. Basis of Design: Bobrick 39747.

D. Automated Soap Dispenser **(SD)**: Liquid soap dispenser, wall-mounted, with stainless steel cover and window to gauge soap level, tumbler lock.
   1. Minimum Capacity: 30 ounces.
   2. Products:
      a. Basis-of-Design: Bobrick B-2012.

E. Soap Dispenser **(SD)**: Liquid soap dispenser, deck-mounted on vanity, with polyethylene container concealed below deck; piston and 4 inch spout of stainless steel with bright polished finish; chrome-plated deck escutcheon.
   1. Minimum Capacity: 20 ounces.
   2. Products:

a. Basis of Design: Bobrick B-822.
3. Makerspace and Kitchenette locations, as indicated on the drawings.

F. Grab Bars **(GB)**: Stainless steel, peened surface.
1. Heavy Duty Grab Bars **(GB)**: Floor supports are not acceptable.
a. Push/Pull Point Load: Minimum 1000 pound-force, minimum.
b. Dimensions: 1-1/2 inch outside diameter, minimum 0.125 inch wall thickness, exposed flange mounting, 1-1/2 inch clearance between wall and inside of grab bar.
c. Configuration and Length:
1) GB-1: Behind water closets: 3’-0” horizontally
2) GB-2: Beside water closets: 3’-6” horizontally
3) GB-3: Beside water closets: 1’-6” vertically
d. Products:

G. Bathroom Shelf **(SH)**: 12" deep stainless steel, wall-mounted, bathroom shelf.
1. Locations: As indicated on the drawings.
2. Basis-of-Design: Advance Tabco Smart Fabrication, Wall Shelves, WS-12-24.

H. Phone Pocket **(KS)**: Wall-mounted mobile device holder with cradle and hook; 0.05 inch thick satin-finished stainless steel, with rolled or hemmed edge at shelf front.
1. Locations: As indicated on the drawings.
2. Product Basis of Design: Bobrick Klutch B-635.

I. Door Opener: Hands Free Door Opener.
1. Locations: Individual Bathrooms (doors without closers)
2. Product Basis-of-Design: StepNPull Silver Finish.

J. Sanitary Napkin Disposal Unit **(ND)**: Stainless steel, surface-mounted, self-closing door, locking bottom panel with full-length stainless steel piano-type hinge, removable receptacle.
1. Products:
a. Basis of Design: Bobrick B-270.
2. Quantity: One at each toilet room, as indicated on the drawings.

K. Period Products Dispenser (**SND**):
1. ABS Resin, anti-rust, tampon and pad dispenser, chrome.
2. Products:
a. Aunt Flow Model E Dispenser, AF-DISP-ESTR-1
b. Provide two refills for dispenser.

L. Robe / Coat Hook **(CH)**:
1. Heavy-duty clothes hook with concealed mounting.
2. Locations: In individual bathrooms as indicated on the drawings.
3. Products:
a. Basis of Design: Bobrick B-2116.

2.05 ELECTRIC HAND/HAIR DRYERS

A. Electric Hand Dryers **(HD)**: Traditional fan-in-case type, with downward fixed nozzle.
1. Operation: Automatic, sensor-operated on and off.
2. Mounting: Surface mounted.
3. Cover: Stainless steel with brushed finish.
a. Tamper-resistant screw attachment of cover to mounting plate.
4. Air Velocity: 4,000 linear feet per minute, minimum.
5. Heater: 500 W, minimum, at full power.
6. Total Wattage: 1500 W, maximum.

2.06 DIAPER CHANGING STATIONS

A. Diaper Changing Station **(BCS)**: Wall-mounted folding diaper changing station for use in commercial toilet facilities, meeting or exceeding ASTM F2285.
1. Material: Stainless steel.

2. Mounting: Recessed, with unit projecting not more than 4 inches from wall when closed.
3. Color: Stainless Steel.
4. Minimum Rated Load: 250 pounds.
5. Products:
   a. Basis of Design: Model KB310-SSRE as manufactured by Bobrick, Koala Kare Child Care Products.

B. Child-Protection Seat **(PS)**:
1. Basis-of-Design Product: Model KB102 as manufactured by Bobrick, Koala Kare Child Care Products .
2. Description: Vertical set unit that opens by folding down from stored position and with child-protection strap.
3. Engineered to support a minimum of 50-lb (113-kg) static load when opened.
4. Material and Finish: HDPE, color to be determined.

2.07 UTILITY ROOM ACCESSORIES

A. Combination Utility Shelf/Mop and Broom Holder: 0.05 inch thick stainless steel, Type 304, with 1/2 inch returned edges, 0.06 inch steel wall brackets.
1. Hooks: Two, 0.06 inch stainless steel rag hooks at shelf front.
2. Mop/broom holders: Three spring-loaded rubber cam holders at shelf front.
3. Length: 34 inches.
4. Product Basis of Design: Bobrick B-239

B. Paper Towel (Roll) Dispenser **(PTD)**:
1. Basis-of-Design Product: Bobrick B-253.
2. Description: Paper Towel Roll dispenser.
3. Mounting: Surface mounted.
4. Operation: Standard spindle.
5. Capacity: Designed for up to 6-inch diameter rolls.
6. Material and Finish: Aluminum, satin with Extruded ABS spindle.
7. Location: Makerspace, Canteen, Breakroom, as indicated on drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

C. For electrically-operated accessories, verify that electrical power connections are ready and in the correct locations.

3.02 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.

B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.

B. Install plumb and level, securely and rigidly anchored to substrate.

C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.
1. Grab Bars: As indicated on drawings.
   a. Mount back to back where possible on toilet partitions to allow for through bolting of units.
   b. Configuration and Length
      1) Beside water closets: 3'-6" horizontally and 1'-6" vertically.
      2) Behind water closets: 3'-0" horizontally

2. Sanitary Napkin Disposal: As directed by Architect and Owner.
3. Other Accessories: As indicated on drawings.

3.04 PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION

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SECTION 10 30 00
BUILT IN FIREPLACE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Built in Fireplace unit.
   2. Built in Electric Log unit.

1.03 SUBMITTALS

A. Submit illustrated specifications of accessories.

B. Shop Drawings: Show layout of unit in wall, coordinated with cut openings in masonry and lintels. Provide coordination drawings showing mechanical and electrical connections and direct venting routing.

1.04 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fireplace unit cleaning and replacement parts.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Environmental Limitations: Do not deliver or install fireplace unit until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.06 COORDINATION

A. Coordinate layout and installation of fireplace unit with adjacent construction, including casework, wall fixtures, HVAC equipment, fire-suppression system, and partitions.

B. Coordinate sizes and locations of equipment with wall depths.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations for fireplace units: Obtain each type of equipment from single manufacturer. Obtain accessories, including necessary hardware, from manufacturer.

2.02 MATERIALS

A. Built –In Fireplace Unit:
   1. Basis of Design: Model GBF1000-PRO as manufactured by Dimplex, 46 inch nominal width unit.
   2. Style: Electric 120/208 3 phase – 4981 BTU
   3. Unit Size: 46 1/2” Wide x 31.75” H x 16” deep
   4. Finish: Black
   5. Quantity: 1, as shown on drawings.
   6. Optional Glass Backer Pane: GBF1000-GLASS
   7. Warranty: 2 year
   8. Water Tanks for 'Opti-Myst Flame Effect'.
   9. Accessories:
      a. Dimplex Wall Switch Remote Control – WRCPF-KIT.
      b. Front Glass Kit -FG1000.

B. Log Kit:
   1. Basis of Design: Model CDFILOG-KIT as manufactured by Dimplex.
   2. Style: Electric 120V – 4,981 BTU

3. Unit Size: 23 3/4” Wide x 19” H x 12 1/2” deep
4. Finish: Black
5. Quantity: 2.
6. Warranty: 2 year

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine walls for suitable masonry conditions where units will be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install specialty items in rigid substantial manner in accordance with manufacturer’s instruction using person fully trained and experienced in installing the items specified.

B. Coordinate the cutting of openings in the wall with masonry joints. Verify mounting heights prior to cutting holes.

C. Coordinate with owner for installation when building is occupied.

D. Coordinate with owner for installation of starter switch.

3.03 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, units are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust equipment to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace equipment that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by equipment manufacturers.

E. Replace units that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

F. At completion of installation, remove and dispose of all cartons, dust, etc. generated by construction.

END OF SECTION

SECTION 10 44 00
FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire extinguishers.

B. Fire extinguisher cabinets.

C. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Wood blocking product and execution requirements.

1.03 REFERENCE STANDARDS

A. NFPA 10 - Standard for Portable Fire Extinguishers; 2017, with Errata (2018).

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide extinguisher operational features.

C. Shop Drawings: Indicate locations of cabinets and cabinet physical dimensions.

D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

1.05 FIELD CONDITIONS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Extinguishers:
   1. Ansul, a Tyco Business: www.ansul.com/#sle.
   2. Kidde, a unit of United Technologies Corp: www.kidde.com/#sle.
   3. Nystrom, Inc: www.nystrom.com/#sle.
   4. Larsen's Manufacturing Co[<>]: www.larsensmfg.com/#sle.
   5. Or Approved Equal.

B. Fire Extinguisher Cabinets and Accessories:
   1. Activar Construction Products Group - JL Industries: www.activarcpg.com/#sle.
   2. Kidde, a unit of United Technologies Corp: www.kidde.com/#sle.
   3. Larsen's Manufacturing Co: www.larsensmfg.com/#sle.
   4. Nystrom, Inc: www.nystrom.com/#sle.
   5. Or Approved Equal.

2.02 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.

B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
   1. Class: A:B:C type.
   2. Size: 10 pound.
   3. Finish: Baked polyester powder coat, red color.
   4. Temperature range: Minus 65 degrees F to 120 degrees F.

2.03 FIRE EXTINGUISHER CABINETS

A. Cabinet Construction: Non-fire rated.
   1. Formed primed steel sheet; 0.036 inch thick base metal.

B. Cabinet Configuration: Semi-recessed type typical.
   1. Size to accommodate accessories.
   2. Trim: Flat rolled edge, with 2 1/2 inch wide face.
   3. Projected Trim: Returned to wall surface, with 2-1/2 inch projection, and 2 1/2 inch wide face.

C. Door: 0.036 inch metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with two butt hinge.

D. Door Glazing: Float glass, clear, 1/8 inch thick, and set in resilient channel glazing gasket.

E. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.

F. Weld, fill, and grind components smooth.

G. Finish of Cabinet Exterior Trim and Door: Baked enamel, color as selected.

H. Finish of Cabinet Interior: White colored enamel.

2.04 ACCESSORIES

A. Extinguisher Brackets: Formed steel, chrome-plated.

B. Wall-Mounting Brackets: Locations as identified on code plans on AG-series sheets.

C. Lettering: FIRE EXTINGUISHER decal, or vinyl self-adhering, pre-spaced black lettering in accordance with authorities having jurisdiction (AHJ).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Secure rigidly in place.

C. Place extinguishers in cabinets.

END OF SECTION

SECTION 10 51 13
METAL LOCKERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal lockers.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Wood blocking and nailers.

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's published data on locker construction, sizes and accessories.

C. Shop Drawings: Indicate locker plan layout, numbering plan and combination lock code.

D. Samples: Submit two samples 6 by 6 inches in size showing color and finish of metal locker material.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect locker finish and adjacent surfaces from damage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Lockers:
   1. DeBourgh Lockers: www.debourgh.com
   2. List Industries, Inc: www.listindustries.com/#sle.
   3. Lockers MFG: www.lockersmfg.com/#sle.
   4. Lyon Workspace Products: www.lyonworkspace.com/#sle.
   5. Penco Products, Inc: www.pencoproducts.com/#sle.
   6. Republic Storage Systems Co: www.republicstorage.com/#sle.

2.02 LOCKER APPLICATIONS

A. Student Lockers: Metal lockers, wall-mounted with leg base.
   1. Width: 12 inches.
   2. Depth: 15 inches.
   3. Height: 60 inches.
   4. Configuration: Single tier.
   5. Fittings: Size and configuration as indicated on drawings.
      a. Hat shelf.
      b. Hooks: Two single prong.
   6. Ventilation: Louvers at top and bottom of door panel.
   7. Locking: Padlock hasps, for padlocks provided by Owner.
   8. Provide sloped top.

2.03 METAL LOCKERS

A. Accessibility: Comply with ICC A117.1 and ADA Standards.

B. Lockers: Factory assembled, made of formed sheet steel, ASTM A653/A653M SS Grade 33/230, with G60/Z180 coating, stretcher leveled; metal edges finished smooth without burrs; baked enamel finished inside and out.
   1. Where ends or sides are exposed, provide flush panel closures.
   2. Color: To be selected by Architect.

C. Locker Body: Formed and flanged; with steel stiffener ribs; electric spot welded.
   1. Body and Shelves: 16 gage, 0.0598 inch.
   2. Base: 16 gage, 0.0598 inch.
   3. Metal Base Height: 4 inch.
      a. Base: 16 gage, 0.0598 inch continuous Zee base.
   4. Knock-down lockers are not acceptable.

D. Frames: Formed channel shape, welded and ground flush, welded to body, resilient gaskets and latching for quiet operation.
   1. Door Frame: 16 gage, 0.0598 inch, minimum.

E. Doors: Channel edge; welded construction, manufacturer's standard stiffeners, grind and finish edges smooth.
   1. Door Thickness: 14 gage, 0.0747 inch, minimum.
   2. Form recess for operating handle and locking device.
      a. Recessed Door Handle and Latch: Stainless-steel cup with integral door pull, recessed so locking device does not protrude beyond door face; pry and vandal resistant.
         1) Multipoint Latching: Finger-lift latch control designed for use with combination padlocks through padlock loop; positive automatic latching.
         2) Latch Hooks: Equip doors 48 inches and higher with three latch hooks and doors less than 48 inches high with two latch hooks; fabricated from 0.120-inch nominal-thickness steel sheet; welded to full-height door strikes; with resilient silencer on each latch hook.
         3) Latching Mechanism: Manufacturer's standard, rattle-free latching mechanism and moving components isolated to prevent metal-to-metal contact.

F. Hinges: Heavy duty, 7-knuckle type; two for doors under 42 inches high; three for doors over 42 inches high.
   1. Hinges: Welded to door and attached to door frame with no fewer than two factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees.

G. Sloped Top: 20 gage, 0.0359 inch, with closed ends.

H. Coat Hooks: Stainless steel or zinc-plated steel.

I. Number Plates: Provide rectangular shaped aluminum plates. Form numbers 3/8 inch high of block font style with ADA designation, in contrasting color.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that prepared bases are in correct position and configuration.

3.02 FABRICATION

A. Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments. Factory weld frame members of each metal locker together to form a rigid, one-piece assembly.

B. Welded Construction: Factory preassemble metal lockers by welding all joints, seams, and connections; with no bolts, nuts, screws, or rivets used in assembly of main locker groups. Factory weld main locker groups into one-piece structures. Grind exposed welds flush. Welded knock-down lockers are not acceptable.

C. Accessible Lockers: Fabricate as follows:
   1. Locate bottom shelf no lower than 15 inches above the floor.
   2. Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inches above the floor.

D. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slip-joint filler angle formed to receive filler panel.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Place and secure on prepared base.

C. Install lockers plumb and square.

D. Secure lockers with anchor devices to suit substrate materials. Minimum Pullout Force: 100 pounds.

E. Bolt adjoining locker units together to provide rigid installation.

F. Install end panels, filler panels, and sloped tops.

G. Install fittings if not factory installed.

H. Replace components that do not operate smoothly.

3.04 CLEANING

A. Clean locker interiors and exterior surfaces.

END OF SECTION

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SECTION 10 82 13
EXTERIOR GRILLES AND SCREENS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Exterior steel screens.

B. Steel assembly framing for direct attachment of screening panels to mechanical equipment; no base or curb required unless shown otherwise on drawings.

1.02 REFERENCE STANDARDS

A. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.

C. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs; 2017.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Submit detailed shop drawings, indicating component profiles, sections, finishes, fastening details, special details, and manufacturer's technical and descriptive data.

C. Samples: Submit samples for color verification, 10 inches by 10 inches minimum.

D. Design Data: Submit comprehensive structural analysis of design for the specified loads. Stamp and sign calculations by professional engineer.

E. Designer's Qualification Statement.

F. Manufacturer's Qualification Statement.

G. Installer's Qualification Statement.

H. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner / Library's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Designer Qualifications: Perform structural design under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in manufacturer's original, unopened packaging, with labels clearly identifying manufacturer and material.

B. Store materials indoors, protected from moisture, humidity, and extreme temperature fluctuations.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective work within a one year period after Date of Substantial Completion.

C. Finish Warranty: Provide manufacturer's ten year warranty on factory finish against cracking, peeling, and blistering.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Exterior Metal Grilles and Screens:
   1. ModWerks; Linea Screens: www.LineaScreen.com
   2. Or Approved Equal.

2.02 SCREENS

A. Steel Screens: Provide shop-fabricated, shop-finished screens assembled into self-draining panels.
   1. Panel Configuration:
   2. Installation: Horizontal.
   3. Frame/Support: Steel members supported from Mechanical Unit.
      a. Framing: Galvanized steel tubing.
      b. Brackets: galvanized steel, welded and galvanized painted.
   4. Panel Material:
      a. Solid metal panel, 26 gauge, R-Panel. Panel to be painted and suitable for outdoor installation. Corrugation direction should be horizontal to meet Architect's specifications

2.03 MATERIALS

A. Roll-formed steel sheet, G90 galvanized in accordance with ASTM A653/A653M.

2.04 FABRICATION

A. Shop fabricate grilles and screens to the greatest extent possible.

B. Disassemble as necessary for shipping and handling, clearly mark units for proper reassembly.

C. Provide supports, anchorages, and accessories as required for complete assembled system.

D. Attach panels to each other by welding, unless otherwise indicated.

E. Framing: Provide fully welded tube framing with adjustable attachment points. Individual frames shall not be wider than 96". Intermediate cross supports shall be horizontal and/or vertical to meet design loads and to provide additional stiffness, support, or attachment points. Frames shall be true and square, with flush edges.

F. Top and side trim shall be galvanized steel. Trims shall be painted to match the panel material or to meet Architect's specifications.

G. Panel materials to be cut to size for fitment into the top and side trim. Panel materials shall be mechanically fastened to the framing. Fasteners shall be located a minimum of 24" o/c in one direction and 24" o/c in the perpendicular direction.

   Vertical and horizontal support members shall be an adjustable, telescoping design to allow:
   1. Adjustment due to sloping roofs.
   2. Unobstructed pathways for service personnel, minimum 48" wide, around the perimeter of the mechanical equipment, or as specified.

H. Attachment bracket to the mechanical equipment shall not allow penetration of the walls or flat roof of the equipment. Attachment shall only penetrate the roof overhang, base rails, or other corner members that do not compromise the weatherproof cabinet. The screening system shall extend flush to the top of the mechanical equipment. The screening system shall extend to the bottom of the mechanical equipment, or to a predetermined point below that level.

I. The screening system shall extend flush to the top of the mechanical equipment.

J. The screening system shall extend to the bottom of the mechanical equipment, or to a predetermined point below that level.

2.05 FINISHES

A. Powder coating as provided by manufacturer.

B. Finish Color: As selected by Architect from manufacturer's standard color range.

2.06 ACCESSORIES

A. Fasteners: ASTM F593 stainless steel or ASTM A307 carbon steel, sizes to suit installation conditions.

B. Anchors and Inserts: Corrosion resistant; type, size, and material required for loading and installation as indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify that painting, roofing, masonry work, and other adjacent work that might damage grille finish have been completed prior to start of installation.

C. Verify that anchorage devices have been properly installed and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's written installation instructions.

B. Set grilles level, plumb, with uniform joints, and in alignment with adjacent work as indicated.

C. Mechanically secure grilles to supporting structure.

D. Do not cut or trim aluminum members without approval of manufacturer; do not install damaged members.

3.03 TOLERANCES

A. Maximum Variation From True Position: 1/4 inch.

3.04 CLEANING

A. Clean finished surfaces as recommended by manufacturer and maintain clean condition until Date of Substantial Completion.

B. Touch-up damaged finish coating using material provided by manufacturer to match original coating.

C. Replace grilles that have been damaged beyond touch-up repair.

3.05 PROTECTION

A. Protect installed grilles to ensure grilles are without damage until Date of Substantial Completion.

END OF SECTION

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SECTION 11 18 10
KEY BOX

GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Government Conditions, Government Contract Clauses, and Division 01 Specification Sections, apply to this Section.

1.02 DESCRIPTION OF WORK

A. This Section includes the following:
   1. Recessed high security government key box (“KNOX BOX”)

1.03 PERFORMANCE REQUIREMENTS

A. Must meet Delavan Fire Department approval and keying requirements.

B. High security U.L. Listed lock.

1.04 SUBMITTALS

A. Product Data: Consisting of manufacturer’s specification, technical data, and installation instructions.

PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, provide products of the following:
   1. Knox Company, 1601 W. Deer Valley Road, Phoenix AZ; 1-800-552-5669.

2.02 GOVERNMENT KEY BOX

A. Provide Knox Company 3200 Series Recess Mounted Hinged Door Model Key box.
   1. ¼” steel housing x ½” thick steel door with interior gasket seal and stainless steel door hinge.
   2. Box and lock to be UL listed.
   3. Lock to have 1/8” thick stainless steel dust cover with tamper seal mounting capability.
   4. Keying: Manufacture to coordinate with the local fire department to provide fire departments city dedicated keying system.
   5. Finish: Knox-coat proprietary finishing process; color to be selected from fll range.
   6. Provide tamper switch.
   7. Locations:
      a. Provide one box outside exterior west door, as noted on code plans.

EXECUTION

3.01 PREPARATION

A. Coordinate exact location with Architect.

3.02 INSTALLATION

A. Coordinate location with Architect.

B. Erect plumb, rigid, properly aligned, and securely fastened in place, complying with manufacturer’s recommendations.

C. Bolt box to wall per manufacturer’s instructions.

END OF SECTION

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SECTION 11 51 50
LIBRARY SPECIALTIES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Book Depository Drop boxes - interior and drive-up.

1.03 SUBMITTALS

A. Submit illustrated specifications of accessories.

B. Shop Drawings: Show layout of units in wall, coordinated with cut openings.

1.04 CLOSEOUT SUBMITTALS

A. Maintenance Data: For book depository hardware.

B. Training for owner in propoer use and operation of unit.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Environmental Limitations: Do not deliver or install library equipment until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.06 COORDINATION

A. Coordinate layout and installation of library equipment with adjacent construction, including doors and frames, wall fixtures, HVAC equipment, fire-suppression system, and partitions.

B. Coordinate sizes and locations of equipment units with wall depths.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations for Library specialties: Obtain each type of equipment from single manufacturer. Obtain accessories, including necessary mounting hardware, from manufacturer.

2.02 MATERIALS

A. Book Depository at Exterior Wall:
   1. Basis of Design: Ease Single Drop Thruwall #10-8100 as manufactured by Kingsley Companies.
   2. Overall Dimensions: 22” W x 20” H
   3. Finish: Stainless Steel with Anti-Graffiti Clear coat
   4. Quantity: 1, as shown on drawings
   5. Mounting Heights: Bottom portion of book drop opening/chute to be 46” above exterior slab.
   6. Accessories:
      a. Built in weather hood
      b. Attached chute housing with entry chute, slide chute and Airblock device.
      c. Sealant and backer rod at interior and exterior joints.
      d. Interior and exterior trim package
      e. Interior Depository lock
      f. Faceplate and lettering on faceplate: "RETURNS" with Braille in English and Spanish.
      g. **Ease Drive-Up ThruWall Extension Kit #19-0003 to accommodate exterior wall thickness.**

7. Warranty: lifetime

B. Freestanding Outdoor Drive-up Book Depository :
1. Basis of Design: 50 C-Series (00-9850) as manufactured by Kingsley Companies.
2. Overall Dimensions: 30” W x 42-15/16” D x 53-5/8” H
3. Depository size: 17-7/8” W x 3-1/2” H
4. Finish: Stainless Steel with Anti-Graffiti Clear coat
5. Quantity: 1, as shown on drawings
6. Mounting Location: As indicated on Drawings.
7. Accessories:
   a. MagnaClose Kit (09-9800)
   b. Lettering on faceplate: "RETURNS" with vinyl in English and Spanish.
8. Warranty: lifetime

C. Freestanding Outdoor Walk-up Book Depository :
1. Basis of Design: 50 S-Series (00-9256) as manufactured by Kingsley Companies.
2. Overall Dimensions: 30” W x 42-15/16” D x 53-5/8” H
3. Depository size: 17-7/8” W x 3-1/2” H
4. Finish: Stainless Steel with Anti-Graffiti Clear coat
5. Quantity: 1, as shown on drawings
6. Mounting Location: As indicated on Drawings.
7. Accessories:
   a. Lettering on faceplate: "RETURNS" with vinyl in English and Spanish.
8. Warranty: lifetime

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine walls for suitable conditions where units will be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install specialty items in rigid substantial manner in accordance with manufacturer’s instruction using person fully trained and experienced in installing the items specified.

B. Verify mounting heights prior to cutting holes.

C. Coordinate with owner for installation when building is occupied.

3.03 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, units are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust equipment doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace equipment that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by equipment manufacturers.

E. Replace units that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

F. At completion of installation, remove and dispose of all cartons, dust, etc. generated by construction.

END OF SECTION

SECTION 12 24 00
WINDOW SHADES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior manual roller shades.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Concealed wood blocking for attachment of headrail brackets.

1.03 REFERENCE STANDARDS

A. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films; 2019.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week prior to commencing work related to products of this section; require attendance of affected installers.

B. Sequencing:
   1. Do not fabricate shades until field dimensions for each opening have been taken with field conditions in place.
   2. Do not install shades until final surface finishes and painting are complete.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets, including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.

C. Shop Drawings: Include shade schedule indicating size, location and keys to details, head, jamb and sill details, mounting dimension requirements for each product and condition, and operation direction.

D. Selection Samples: Include fabric samples in full range of available colors and patterns.

E. Verification Samples: Minimum size 6 inches square, representing actual materials, color and pattern.

F. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of product.

G. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of shop drawings.

H. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner / Library's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.

B. Installer Qualifications: Company specializing in performing work of this type with minimum five years of documented experience with shading systems of similar size and type.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver shades in manufacturer's unopened packaging, labeled to identify each shade for each opening.

B. Handle and store shades in accordance with manufacturer's recommendations.

1.08 FIELD CONDITIONS

A. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.09 WARRANTY

A. Provide manufacturer's warranty from Date of Substantial Completion, covering the following:
   1. Shade Hardware: Twenty-Five Years.
   2. Fabric: Twenty-Five Years.
   3. Motor: Five Years

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Interior Manually Operated Roller Shades:
   1. Draper, Inc; Clutch Operated FlexShade: www.draperinc.com/#sle.
   2. Hunter Douglas Architectural; RB500 Manual Roller Shades: www.hunterdouglasarchitectural.com/#sle.
   3. Lutron Electronics Co., Inc; Contract Roller Manual Roller Shades: www.lutron.com/#sle.
   4. MechoShade Systems LLC; Mecho/5 System: www.mechoshade.com/#sle.
   5. SWFcontract, a division of Springs Window Fashions, LLC.: www.swfcontract.com/#sle.
   6. WT Shade; https://wtshade.com/
   7. Or approved equal.

B. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

2.02 ROLLER SHADES

A. General:
   1. Provide shade system components that are easy to remove or adjust without removal of mounted shade brackets.
   2. Provide shade system that operates smoothly when shades are raised or lowered.

B. Roller ShadesWS-1 (manual):
   1. Description - Interior Roller Shades: Single roller, manually operated fabric window shade system complete with mounting brackets, roller tubes, hembars, hardware, and accessories. See schedule for shade type.
      a. Drop Position: Regular roll.
      b. Roll Direction: Roll down, closed position is at window sill.
      c. Mounting: Recess mounted in ceiling pocket or as indicated in the schedule.
   2. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
   3. Roller Tubes: As required for type of shade operation.
      a. Material: Extruded aluminum, baked enamel; color from manufacturer's standards.
      b. Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.
      c. Fabric Attachment: Utilize extruded channel in tube to accept vinyl spline welded to fabric edge with end caps.
   4. Hembars: Designed to maintain bottom of shade straight and flat.
      a. Style: Full wrap fabric covered bottom bar, flat profile with heat sealed closed ends.
   5. Manual Operation for Interior Shades:
      a. Clutch Operator: Manufacturer's standard material and design, permanently lubricated.
      b. Drive Chain: Continuous loop beaded ball chain, 95 pounds minimum breaking strength. Provide upper and lower limit stops.
         1) Loop Length: To extend to 4'-0" above finished floor.
         2) Material: Stainless steel
      c. Shade Lift Assistance: Manufacturer's standard spring device contained in the idler end of roller tube to reduce force required to lift shades; as required based on shade weight. No more than 10 lbs of force to operate shade.
      d. Chain Retainer:

1) Manufacturer's standard clip. Wall mounted. Where two windows are located next to each other, locate chains for each shade between adjacent window.

6. Accessories:
   a. Fascia: Extruded aluminum, size as required to conceal shade mounting, attachable to brackets without exposed fasteners; fabric wrapped finish to match shade.
      1) Profile: Square.

2.03 SHADE FABRIC

A. Fabric: Nonflammable, color-fast, impervious to heat and moisture, and able to retain its shape under normal operation. PVC-Free; 100 percent recycled.
   1. Material: Vinyl coated fiberglass.
   2. Performance Requirements:
      a. Flammability: Pass NFPA 701 large and small tests.
   3. Openness Factor: As indicated in specification section 09 00 00 "Finish and Material Legend".
   4. Type: Woven +/-65% Vinyl with +/- Polyester.
   5. Weave: Dense Basketweave
   6. Mounting: Inside (between jambs).
   7. Color: As indicated in specification section 09 00 00 "Finish and Material Legend"

2.04 ROLLER SHADE FABRICATION

A. Field measure finished openings prior to ordering or fabrication.

B. Dimensional Tolerances: Fabricate shades to fit openings within specified tolerances.
   1. Vertical Dimensions: Fill openings from head to sill with 1/2 inch space between bottom bar and window stool.
   2. Horizontal Dimensions - Inside Mounting: Fill openings from jamb to jamb.

C. At openings requiring continuous multiple shade units with separate rollers, locate roller joints at window mullion centers; butt rollers end-to-end.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine finished openings for deficiencies that may preclude satisfactory installation.

B. Start of installation shall be considered acceptance of substrates.

3.02 PREPARATION

A. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.

B. Coordinate with window installation and placement of concealed blocking to support shades.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.

B. Adjust level, projection, and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

3.04 CLEANING

A. Clean soiled shades and exposed components as recommended by manufacturer.

B. Replace shades that cannot be cleaned to "like new" condition.

3.05 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

B. See Section 01 79 00 - Demonstration and Training, for additional requirements.

C. Training: Train Owner / Library's personnel on operation and maintenance of system.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
2. Provide minimum of two hours training by manufacturer's authorized personnel at location designated by the Owner / Library.

3.06 PROTECTION

A. Protect installed products from subsequent construction operations.

B. Touch-up, repair, or replace damaged products before Substantial Completion.

3.07 SCHEDULE

RM #	RM NAME	QTY	SHADE TAG	SHADE TYPE	LOCATION	WINDOW TYPE	APPROX. DIMENSIONS
109	MEETING ROOM	3	WS-3	BLACKOUT	EXTERIOR	W-9	6'-0"W x 7'-4"H
110	STORYTIME	2	WS-3	BLACKOUT	EXTERIOR	W-9	6'-0"W x 7'-4"H
113	STUDY	1	WS-1	SOLAR	EXTERIOR	W-6	4'-0"W x 10'-10"H
114	STUDY	1	WS-1	SOLAR	EXTERIOR	W-6	4'-0"W x 10'-10"H
115	NONFICTION - ADULT	3	WS-1	SOLAR	EXTERIOR	W-7	5'-4"W x 7'-4"H
123	ASSIST. DIR	1	WS-1	SOLAR	INTERIOR	W-1	4'-0"X x 4'-0"H
132	JUV. COLLECTIONS	3	WS-1	SOLAR	EXTERIOR	W-7	5'-4"W x 7'-4"H
135	DISCOVER ZONE	3	WS-1	SOLAR	EXTERIOR	W-1	4'-0"W x 3'-0"H
135	DISCOVER ZONE	9	WS-1	SOLAR	EXTERIOR	W-3	2'-0"W x 4'-0"H
136	ADULT SEATING	2	WS-1	SOLAR	EXTERIOR	W-6	4'-0"W x 10'-10"H
140	FICTION - ADULT	3	WS-1	SOLAR	EXTERIOR	W-7	5'-4"W x 7'-4"H
140	FICTION - ADULT	1	WS-1	SOLAR	EXTERIOR	W-7	5'-4"W x 7'-4"H
145	PUBLIC COMPUTERS	1	WS-2	SOLAR	EXTERIOR	W-7	5'-4"W x 7'-4"H
154	TECHNICAL SERVICES	2	WS-1	SOLAR	EXTERIOR	EXISTING	4'-1" X 4'-3"
156	CANTEEN	3	WS-1	SOLAR	INTERIOR	W-1	4'-0"W x 3'-0"H
166	FRIENDS	4	WS-1	SOLAR	EXTERIOR	EXISTING	4'-1" X 4'-3"
172	STAFF BREAKROOM	4	WS-1	SOLAR	EXTERIOR	EXISTING	4'-1" X 4'-3"
174	YOUTH STORAGE	2	WS-1	SOLAR	EXTERIOR	EXISTING	4'-1" X 4'-3"

END OF SECTION

SECTION 12 36 00
COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Countertops for architectural cabinet work.

B. Window Sills.

C. Wall-hung counters and vanity tops.

1.02 RELATED REQUIREMENTS

A. Section 06 41 00 - Architectural Wood Casework.

B. Section 22 40 00 - Plumbing Fixtures: Sinks.

1.03 REFERENCE STANDARDS

A. ANSI A208.2 - Medium Density Fiberboard (MDF) for Interior Applications; 2022.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.

C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014, with Errata (2018).

D. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1; 2017, with Errata (2019).

E. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.

F. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

G. PS 1 - Structural Plywood; 2009 (Revised 2019).

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Specimen warranty.

C. Shop Drawings: Complete details of materials and installation ; combine with shop drawings of cabinets and casework specified in other sections.

D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.

E. Verification Samples: For each finish product specified, minimum size 6 inches square, representing actual product, color, and patterns.

F. Test Reports: Chemical resistance testing, showing compliance with specified requirements.

G. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 FIELD CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.01 COUNTERTOPS

A. Plastic Laminate Countertops: High-pressure decorative laminate (HPDL) sheet bonded to substrate.
   1. Laminate Sheet: NEMA LD 3, Grade HGS, 0.048 inch nominal thickness.
      a. Manufacturers:
         1) Arborite: www.arborite.com/#sle.
         2) Formica Corporation: www.formica.com/#sle.
         3) Panolam Industries International, Inc; Pionite Standard HPL: www.panolam.com/#sle.
         4) Wilsonart: www.wilsonart.com/#sle.
         5) Or Approved Equal.
      b. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
      c. Wear Resistance: In addition to specified grade, comply with NEMA LD 3 High Wear Grade requirements for wear resistance.
      d. Finish: Matte or suede, gloss rating of 5 to 20.
      e. Surface Color and Pattern: As indicated in Specification Section 09 00 00 "Finish and Materials Legend".
   2. Other Components Thickness: 1/2 inch, minimum.
   3. Exposed Edge Treatment: Square, substrate built up to minimum 1-1/4 inch thick; covered with matching laminate.
   4. Back and End Splashes: Same material, same construction.
   5. Fabricate in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 11 - Countertops, Custom Grade.
   6. Fabricate in accordance with manufacturer's standard requirements.

B. Solid Surfacing Countertops: Solid surfacing sheet or plastic resin casting over continuous substrate.
   1. Flat Sheet Thickness: 1/2 inch, minimum.
   2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
      a. Manufacturers:
         1) Avonite Surfaces: www.avonitesurfaces.com/#sle.
         2) Dupont: www.corian.com/#sle.
         3) Formica Corporation: www.formica.com/#sle.
         4) Meganite, Inc: www.meganite.com/#sle.
         5) Staron: www.staron.com
         6) Wilsonart: www.wilsonart.com/#sle.
         7) Or approved equal.
      b. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
      c. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
      d. Color and Pattern: As indicated in Specification Section 09 00 00 "Finish and Materials Legend"..
   3. Other Components Thickness: 1/2 inch, minimum.
   4. Exposed Edge Treatment: Built up to minimum 1 inch thick; bullnosed edge.

5. Back and End Splashes: Same sheet material, square top; minimum 4 inches high.
   a. Fabricate tops with loose backsplashes for field application.
6. Fabricate in accordance with manufacturer's standard requirements.

2.02 MATERIALS

A. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch thick; join lengths using metal splines.

B. Solid Epoxy Resin: Modified epoxy resin and non-asbestos inert fillers cast into sheets.

C. Medium Density Fiberboard for Supporting Substrate: ANSI A208.2.

D. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.

E. Joint Sealant: Mildew-resistant silicone sealant, clear.

2.03 FABRICATION

A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
   1. Join lengths of tops using best method recommended by manufacturer.
   2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
   3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.

B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
   1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
   2. Height: 4 inches, unless otherwise indicated.

C. Solid Surfacing: Fabricate tops and wall panels up to 144 inches long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.

D. Wall-Mounted Counters: Provide skirts, aprons, brackets, braces, and grommets as indicated on drawings, finished to match.
   1. Wall Brackets: Satin Stainless Steel stamped metal brackets.
      a. Product: Subject to compliance with requirements, provide Large Work Surface Support, SWS4, by Doug Mockett & Company, Inc. 24-1/4-inch by 18-1/4-inch.
      b. Product: Subject to compliance with requirements, provide Small Basic Work Surface Support, SWS4A, by Doug Mockett & Company, Inc. 12-1/4-inch by 8-1/4-inch.
   2. Grommets for Cable Passage through Countertops: 2-inch OD, molded-plastic grommets and matching plastic caps with slot for wire passage. Color to be selected from manufacturer's standard range.
      a. Product: Subject to compliance with requirements, provide "OG series" by Doug Mockett & Company, Inc.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.

B. Attach plastic laminate countertops using screws with minimum penetration into substrate board of 5/8 inch.

C. Seal joint between back/end splashes and vertical surfaces.

3.04 TOLERANCES

A. Variation From Horizontal: 1/8 inch in 10 feet, maximum.

B. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.

C. Field Joints: 1/8 inch wide, maximum.

3.05 CLEANING

A. Clean countertops surfaces thoroughly.

3.06 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 12 64 00
UPHOLSTERED ASSEMBLIES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Upholstered Seat Cushion

1.03 PERFORMANCE REQUIREMENTS

A. Support Capability: Upholstered window seating able to support an evenly distributed 50-pound per square foot static load or 300-pound concentrated load without failure or other conditions that might impair furniture's usefulness.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes.

B. Samples for Verification: For each type of Upholstery Fabric.
   1. Fabric Samples for Verification: For each color and pattern indicated, 8-inches square, from dye lot to be used for the work and specified textile treatments applied.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance Data: Information on cleaning and repair of window seat upholstery.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Scheduling: Do not deliver or install products until after other finish work, including painting, is complete and spaces are otherwise ready for occupancy.

PART 2 PRODUCTS

2.01 MATERIALS

A. General: All materials, construction and finishing shall be of the highest quality.

B. Wood Products, General: Provide materials that comply with WIC "Custom" quality standard unless otherwise indicated.

C. Adhesives, General: Do not use adhesives that contain urea formaldehyde.

D. VOC Limits for Installation Adhesives and Flues: Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
   1. Wood Glues: 30 g/L.
   2. Contact Adhesive: 250 g/L.

2.02 WOOD PRODUCT FABRICATION, GENERAL

A. Wood Product Grade: Provide WIC Custom grade construction complying with referenced quality standard.

B. Wood Product Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

C. Fabricate wood product to dimensions, profiles, and details indicated.

2.03 UPHOLSTERED CUSHION

A. Seat Structure: Plywood Backing

B. Cushion: 3” Thick Latex Foam Cushion

C. Upholstery Stitching: Double needle reinforced, utilizing commercial quality thread of fiber compatible with upholstery fiber compositions.

D. End Construction: Finished upholstered, both sides.

E. Anchoring: Anchored to bench and seats, as indicated on drawings.

F. Fabric: As indicated in Specification Section 09 00 00 "Finish and Materials Legend".

PART 3 EXECUTION

3.01 INSTALLATION

A. Protection: Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure that products are without damage or deterioration at time of Substantial Completion.

B. Cleaning: Wipe clean of dirt and debris after installation.

END OF SECTION

SECTION 14 24 00
HYDRAULIC ELEVATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Complete hydraulic elevator systems - **NEW CAB ONLY**.
   1. Passenger type.

B. Elevator Maintenance Contract.

1.02 RELATED REQUIREMENTS

A. Section 09 68 16 - Sheet Carpet: Floor finish in car.

B. Section 22 05 13 - Common Motor Requirements for Plumbing Equipment: Motor for sump pump in pit.

C. Section 26 05 33.13 - Conduit for Electrical Systems:

D. Section 26 05 83 - Wiring Connections:

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.

B. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).

C. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

D. AISC 360 - Specification for Structural Steel Buildings; 2016.

E. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015.

F. ASME A17.1 - Safety Code for Elevators and Escalators; 2019.

G. ASME A17.2 - Guide for Inspection of Elevators, Escalators, and Moving Walks; 2020.

H. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

I. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2017.

J. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.

K. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

L. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2018.

M. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021.

N. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2020.

O. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.

P. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.

Q. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020.

R. ITS (DIR) - Directory of Listed Products; Current Edition.

S. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

T. NEMA MG 1 - Motors and Generators; 2018.

U. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

V. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2019.

W. PS 1 - Structural Plywood; 2009 (Revised 2019).

X. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate work with other installers for equipment provisions necessary for proper elevator operation, including but not limited to, the following:
      a. Automatic transfer switches with auxiliary contacts for emergency power transfer status indication.
      b. Shunt trip devices for automatic disconnection of elevator power prior to fire suppression system activation.
      c. Overcurrent protection devices selected to achieve required selective coordination.

B. Preinstallation Meeting: Convene meeting at least one week prior to start of this work.
   1. Review schedule of installation, proper procedures and conditions, and coordination with related work.

C. Construction Use of Elevator: Provide designated elevator for transport of construction personnel and materials in compliance with ASME A17.1.
   1. Make elevator available for construction use as early as possible.
   2. Enclose car with protective plywood on floor, walls, and ceiling.
   3. Provide temporary lighting.
   4. Provide control panel with manual and emergency operation.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Submit data on following items:
   1. Signal and operating fixtures, operating panels, and indicators.
   2. Car design, dimensions, layout, and components.
   3. Electrical characteristics and connection requirements.

C. Shop Drawings: Include appropriate plans, elevations, sections, diagrams, and details on following items:
   1. Elevator Equipment and Machines: Size and location of driving machines, power units, controllers, governors, and other components.
   2. Clearances and over-travel of car.
   3. Location and sizes of hoistway and car doors and frames.
   4. Electrical characteristics and connection requirements.
   5. Indicate arrangement of elevator equipment and allow for clear passage of equipment through access openings.

D. Manufacturer's Qualification Statement.

E. Installer's Qualification Statement.

F. Testing Agency's Qualification Statement.

G. Initial Maintenance Contract.

H. Maintenance Contract: Submit proposal to Owner for standard two year continuing maintenance contract agreement in accordance with ASME A17.1 and requirements as indicated, starting on date initial maintenance contract is scheduled to expire.
   1. Indicate in proposal the services, obligations, conditions, and terms for agreement period and for renewal options.

I. Operation and Maintenance Data:

1. Parts catalog with complete list of equipment replacement parts; identify each entry with equipment description and identifying code.
2. Operation and maintenance manual.
3. Schematic drawings of equipment and hydraulic piping, and wiring diagrams of installed electrical equipment with list of corresponding symbols to identify markings on machine room and hoistway apparatus.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years documented experience.

B. Installer Qualifications: Trained personnel and supervisor on staff of elevator equipment manufacturer.

C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of type specified in this section.

D. Products Requiring Fire Resistance Rating: Listed and classified by ITS (DIR), UL (DIR), or testing agency acceptable to authorities having jurisdiction.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Provide manufacturer's warranty for elevator operating equipment and devices for one year from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hydraulic Elevator Manufacturers:
1. Otis Elevator Company; HydroFit: www.otis.com/#sle.
2. Schindler Elevator Corporation; _____: www.schindler.com/#sle.
3. Or Approved Equal

2.02 HYDRAULIC ELEVATORS

A. Hydraulic Passenger Elevator, No. 149:
1. Hydraulic Elevator Equipment: Existing in Place Elevator Equipment to be reused.
2. Service Control Type:
   a. Standard service control only.
3. Rated Net Capacity: 2500 pounds.
4. Rated Speed: 100 feet per minute.
5. Hoistway Size: Existing
6. Interior Car Platform Size: As indicated on drawings - Existing.
7. Elevator Pit Depth: 48 inch - Existing.
8. Overhead Clearance at Top Floor: 144 inch - Verify Existing.
9. Travel Distance: As indicated on drawings - Field Verify.
10. Number of Stops: 3.
11. Number of Openings: 2 Front; 1 Rear.
12. Hydraulic Equipment Location: As indicated on drawings - Existing

2.03 COMPONENTS

A. **Provide necessary components for a code-compliant elevator cab in the existing hoistway.**

B. Elevator Equipment:
1. Motors, Hydraulic Equipment, Controllers, Controls, Buttons, Wiring, Devices, and Indicators: Comply with NFPA 70; see Section 26 05 83.
2. Guide Rails, Cables, Buffers, Attachment Brackets and Anchors: Design criteria for components includes safety factors in accordance with applicable requirements of Elevator Code, ASME A17.1.

3. Buffers:
4. Lubrication Equipment:

C. Electrical Equipment:
1. Motors: NEMA MG 1.
2. Boxes, Conduit, Wiring, and Devices: As required by NFPA 70; see Sections 26 05 33.13 and 26 05 83.
3. Sump Pump in Pit: See Section 22 05 13.
4. Spare Conductors: Provide ten percent in extra conductors and two pairs of shielded audio cables in traveling cables.
5. Include wiring and connections to elevator devices remote from hoistway and between elevator machine room. Provide additional components and wiring to suit machine room layout. See Section 26 05 83.

2.04 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with ASME A17.1, applicable local codes, and authorities having jurisdiction (AHJ).

B. Accessibility Requirements: Comply with ADA Standards.

C. Perform structural steel design, fabrication, and installation in accordance with AISC 360.

D. Perform welding of steel in accordance with AWS D1.1/D1.1M.

E. Fabricate and install door and frame assemblies in accordance with NFPA 80 and in compliance with requirements of authorities having jurisdiction.

F. Perform electrical work in accordance with NFPA 70.

2.05 OPERATION CONTROLS

A. Elevator Controls: Provide landing operating panels and landing indicator panels.
1. Landing Operating Panels: Metallic type, one for originating "Up" and one for originating "Down" calls, one button only at terminating landings; with illuminating indicators.
2. Landing Indicator Panels: Illuminating.
3. Comply with ADA Standards for elevator controls.

B. Interconnect elevator control system with building security, fire alarm, card access, and smoke alarm systems.

C. Door Operation Controls:
1. Program door control to open doors automatically when car arrives at floor landing.
2. Render "Door Close" button inoperative when car is standing at dispatch landing with doors open.
3. Door Safety Devices: Moveable, retractable safety edges, quiet in operation; equipped with photo-electric light rays.

D. Provide "Firefighter's Emergency Operation" in accordance with ASME A17.1, applicable building codes, and authorities having jurisdiction (AHJ).

2.06 OPERATION CONTROL TYPE

A. Single Automatic (Push Button) Operation Control: Applies to car in single elevator shaft.
1. Refer to description provided in ASME A17.1.
2. Set system operation so that momentary pressure of landing button dispatches car from other landing to that landing.
3. Allow call registered by momentary pressure of landing button at any time to remain registered until car stops in response to that landing call.
4. If elevator car door is not opened within predetermined period of time after car has stopped at terminal landing allow car to respond to call registered from other landing.

2.07 EMERGENCY POWER

A. Set-up elevator operation to run with elevator emergency power supply when the normal building power supply fails, and in compliance with ASME A17.1 requirements.

B. Elevator Emergency Power Supply: Supplied by battery backup; provide elevator system components as required for emergency power characteristics.

C. Emergency Lighting: Comply with ASME A17.1 elevator lighting requirements.

D. Provide operational control circuitry for adapting the change from normal to emergency power.

E. Upon transfer to emergency power, advance one elevator at a time to a pre-selected landing, stop car, open doors, disable operating circuits, and hold in standby condition.

2.08 MATERIALS

A. Rolled Steel Sections, Shapes, Rods: ASTM A36/A36M.

B. Steel Sheet: ASTM A1008/A1008M, Designation CS (commercial steel), with matte finish.

C. Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

D. Stainless Steel Sheet: ASTM A666, Type 304; No. 4 Brushed finish unless otherwise indicated.

E. Stainless Steel Bars, Shapes and Moldings: ASTM A276/A276M, Type 304.

F. Extruded Aluminum: ASTM B221 (ASTM B221M), natural anodized finish unless otherwise indicated.

G. Aluminum Sheet: ASTM B209/B209M, 3105 alloy, O temper.

H. Plywood: PS 1, Structural I, Grade C-D or better, sanded.

I. Tempered Glass: 3/8 inch minimum thickness, fully tempered in compliance with ASME A17.1, 16 CFR 1201, ANSI Z97.1, and ASTM C1048 tempered glass requirements.

J. Carpet Flooring: See Section 09 68 16.

K. Plastic Laminate: NEMA LD 3, Type HGS, color as selected by Architect from manufacturer's standard line of colors.

2.09 CAR AND HOISTWAY ENTRANCES

A. Elevator, No. 149:
   1. Car and Hoistway Entrances, Main Elevator Lobby
      a. Framed Opening Finish and Material: Brushed stainless steel.
      b. Car Door Material: Stainless steel, with rigid sandwich panel construction.
      c. Hoistway Door Material: Stainless steel, with rigid sandwich panel construction.

2.10 CAR EQUIPMENT AND MATERIALS

A. Elevator Car, No. 149:
   1. Car Operating Panel: Provide main and auxiliary; flush-mounted applied face plate, with illuminated call buttons corresponding to floors served with "Door Open/Door Close" buttons, "Door Open" button, "Door Close" button, and alarm button.
      a. Panel Material: Integral with front return; one per car.
      b. Car Floor Position Indicator: Above door with illuminating position indicators.
      c. Locate alarm button where it is unlikely to be accidentally actuated; not more than 54 inch above car finished floor.
   2. Flooring: Carpeting.
   3. Front Return Panel: Match material of car door.
   4. Door Wall: Plastic laminate on plywood.
   5. Hand Rail: Aluminum, at all three sides. Provide open clearance space 1-1/2 inch (38 mm) wide to face of wall.
      a. Aluminum Finish: Clear anodized.
   6. Ceiling:

a. Lay-in Panel: Aluminum sheet.

7. Provide emergency access panel for egress from car at ceiling.

B. Car Accessories:

1. Certificate Frame: Stainless steel frame glazed with tempered glass, and attached with tamper-proof screws.
2. Protective Pads: Canvas cover, padded with impact-resistant fill material, sewn with piping edges; fire resistant in compliance with ASME A17.1; brass grommets for supports, covering side and rear walls and front return, with cut-out for control panel; provide one set for each elevator.
   a. Color: As selected by Architect.
   b. Provide at least 4 inch clearance from bottom of pad to finished floor.
   c. Pad Supports: Stainless steel studs, and mounted from ceiling frame.

2.11 FINISHES

A. Clear Anodized Finish: Class I, AAMA 611 AA-M12C22A41, clear anodic coating with electrolytically deposited organic seal; not less than 0.7 mil, 0.0007 inch thick.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting this work.

B. Verify that hoistway, pit, and machine room are ready for work of this section.

C. Verify hoistway shaft and openings are of correct size and within tolerance.

D. Verify location and size of machine foundation and position of machine foundation bolts.

E. Verify that electrical power is available and of correct characteristics.

3.02 PREPARATION

A. Arrange for temporary electrical power for installation work and testing of elevator components; see Section 01 50 00 - Temporary Facilities and Controls for additional requirements.

B. Maintain elevator pit excavation free of water.

3.03 INSTALLATION

A. Coordinate this work with installation of hoistway wall construction.

B. Install system components, and connect equipment to building utilities.

C. Provide conduit, electrical boxes, wiring, and accessories; see Sections 26 05 33.13 and 26 05 83.

D. Install hydraulic piping between cylinder and pump unit.

E. Mount machines, motors, and pumps on vibration and acoustic isolators.

1. Place on structural supports and bearing plates.
2. Securely fasten to building supports.
3. Prevent lateral displacement.

F. Install hoistway, elevator equipment, and components in accordance with approved shop drawings.

G. Install guide rails to allow for thermal expansion and contraction movement of guide rails.

H. Accurately machine and align guide rails, forming smooth joints with machined splice plates.

I. Install hoistway door sills, frames, and headers in hoistway walls; grout sills in place, set hoistway floor entrances in alignment with car openings, and align plumb with hoistway.

J. Structural Metal Surfaces: Clean surfaces of rust, oil or grease; wipe clean with solvent; prime two coats.

K. Wood Surfaces not Exposed to Public View: Finish with one coat primer; one coat enamel.

L. Adjust equipment for smooth and quiet operation.

3.04 TOLERANCES

A. Guide Rail Alignment: Plumb and parallel to each other in accordance with ASME A17.1 and ASME A17.2.

B. Car Movement on Aligned Guide Rails: Smooth movement, without any objectionable lateral or oscillating movement or vibration.

3.05 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

3.06 ADJUSTING

A. Adjust for smooth acceleration and deceleration of car to minimize passenger discomfort.

B. Adjust with automatic floor leveling feature at each floor landing to reach 1/4 inch maximum from flush with sill.

3.07 CLEANING

A. Remove protective coverings from finished surfaces.

B. Clean surfaces and components in accordance with manufacturers written instructions.

3.08 CLOSEOUT ACTIVITIES

A. Demonstrate proper operation of equipment to Owner / Library's designated representative.

3.09 PROTECTION

A. Do not permit construction traffic within car after cleaning.

B. Protect installed products until Date of Substantial Completion.

C. Touch-up, repair, or replace damaged products and materials prior to Date of Substantial Completion.

3.10 MAINTENANCE

A. Provide Initial Maintenance Contract of elevator system and components in accordance with ASME A17.1 and requirements as indicated for 3 months from Date of Substantial Completion.

B. Perform maintenance contract services using competent and qualified personnel under the supervision and direct employ of the elevator manufacturer or original installer.

C. Include systematic examination, adjustment, and lubrication of elevator equipment.

D. Perform work without removing cars from use during peak traffic periods.

END OF SECTION

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PROJECT MANUAL – VOL 2

Construction Documents

Delavan Public Library
Addition and Renovation

404 E Walworth Ave
Delavan, WI 53115

Volume 2 of 2

Divisions 21 - 33

FEH Project No. 2023403

7 April 2025

FEH DESIGN
ARCHITECTURE / ENGINEERING / INTERIORS

SIOUX CITY, IA 712 252 3889 / DES MOINES, IA 515 288 2000 / DUBUQUE, IA 563 583 4900 / MILWAUKEE, WI 414 200 9660

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SECTION 00 01 01
PROJECT TITLE PAGE

PROJECT MANUAL

FOR

DELAVAN PUBLIC LIBRARY ADDITION AND RENOVATION

FEH DESIGN PROJECT NUMBER: 2023403

CITY OF DELAVAN / DELAVAN PUBLIC LIBRARY
404 E. WALWORTH AVE
DELAVAN , WISCONSIN 53115

DATE: 04-07-2025

PREPARED BY:

FEH DESIGN

END OF SECTION

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SECTION 00 01 02
PROJECT INFORMATION

PART 1 GENERAL

1.01 PROJECT IDENTIFICATION

A. Project Name: Delavan Public Library Addition and Renovation, located at:

404 E. Walworth Ave.

Delavan, Wisconsin53115.

B. The Owner, hereinafter referred to as Owner / Library: City of Delavan or Delavan Public Library

1.02 NOTICE TO PROSPECTIVE BIDDERS

A. These documents constitute an Invitation to Bid to General Contractors for the construction of the project described below.

1.03 PROJECT DESCRIPTION

A. Summary Project Description: An addition and renovation to the existing Aram Public Library in Delavan, WI.

1.04 PROJECT CONSULTANTS

A. The Architect, hereinafter referred to as Architect:
1. Company: FEH DESIGN
2. Address: 951 Main Street.
3. City, State, Zip: Dubuque , IA 52001 .
4. Contact: Christy Monk, Daniel Rojano.
5. Phone/Fax: 563.583.4900.
6. E-mail: christym@fehdesign.com, danielr@fehdesign.com.

B. Structural Engineer
1. Company: FEH DESIGN
2. Address: 951 Main Street
3. City, State, Zip: Dubuque , IA 52001
4. Contact: Bryan Blair , Elliot Carlovsky
5. Phone/Fax: 563.583.4900
6. E-mail: bryanb@fehdesign.com , elliotc@fehdesign.com

C. Mechanical Engineer
1. Company: Henneman Engineering, Inc.
2. Address: 20855 Watertown Road , Suite 170
3. City, State, Zip: Waukesha , WI 53186
4. Contact: Jim Zadra
5. Phone/Fax: 262.901.0626
6. E-mail: jzadra@henneman.com

D. Electrical Engineer
1. Company: Henneman Engineering, Inc.
2. Address: 20855 Watertown Road, , Suite 170
3. City, State, Zip: Waukesha , WI 53186
4. Contact: Adam Abston
5. Phone/Fax: 262.901.0626
6. E-mail: aabston@henneman.com

E. Technology Engineer
1. Company: Henneman Engineering, Inc.
2. Address: 1241 John Q. Hammons Dr. Suite 503
3. City, State, Zip: Madison, WI 53717

4. Contact: Tim Cole
5. Phone: 608.833.7000
6. E-mail: tcole@henneman.com

F. Civil Engineer
1. Company: Snyder and Associates
2. Address: 5010 Voges Road
3. City, State, Zip: Madison , WI 53718
4. Contact: Scott Anderson
5. Phone: 608.838.0444
6. E-mail: sanderson@snyder-associates.com

G. Landscape Architect
1. Company: Snyder and Associates
2. Address: 5010 Voges Road
3. City, State, Zip: Madison , WI 53718
4. Contact: Andy Meessmann
5. Phone/Fax: 608.838.0444
6. E-mail: ameessmann@snyder-associates.com

1.05 PROCUREMENT TIMETABLE

A. Pre-Bid Meeting/Tour: 04-14-2025 at 3:00 PM

B. Last Request for Substitution Due: 7 days prior to due date of bids.

C. Last Request for Information Due: 7 days prior to due date of bids.

D. Bid Date: 05-07-2025

E. Bid Opening: Same day, after 10:00 AM local time bids due.

F. Bids May Not Be Withdrawn Until: 60 days after due date.

G. Desired Substantial Completion Date: 08-28-2026

H. Desired Final Completion Date: Not later than 30 calendar days past Substantial Completion.

I. The Owner / Library reserves the right to change the schedule or terminate the entire procurement process at any time.

1.06 PROCUREMENT DOCUMENTS

A. Availability of Documents: Complete sets of procurement documents may be obtained:
1. At the following address: www.cityblueplanroom.com.
2. At the following address:
   a. CityBlue Technologies
   b. 4653 44th Street
   c. Rock Island , IL 61201
   d. 800.747.6500

B. Documents are available at the following construction plan rooms:
1. Builders Association of Missouri, 720 Oak Street, Kansas City, Missouri 64106
2. Builders Exchange of Rochester, 108 Elton Hills Lane NW, Rochester, MN 55901
3. Central Illinois Plan Room, 1620 S. 5th Street, Springfield, IL 62703
4. Construct Connect, 28 N. Clark Street, Suite 450, Chicago, IL 60602
5. LaCrosse Builders Exchange, 427 Gillette Street, La Crosse, WI 54603
6. Master Builders of Iowa, 221 Park St., Des Moines, IA 50303
7. Minnesota Builders Exchange, 1123 Glenwood Ave., Minneapolis, MN 55405
8. North Iowa Builders Exchange, 15 W. State St, P. O. Box 1128, Mason City, IA 50401
9. Omaha Builders Exchange, 4159 South 94th Street, Omaha, NE 68127
10. Springfield Blueprint, 1620 S Fifth Street, Springfield, IL 62703
11. Northern Illinois Building Contractors Association, info@nibca.build

1.07 BID SECURITY

A. Bids shall be accompanied by a security deposit as follows:
   1. Bid Bond of a sum no less than 5 percent of the Bid Amount on AIA A310 Bid Bond Form. Or
   2. Certified check in the amount of no less than 5 percent of the Bid Amount.

PART 2 PRODUCTS (NOT USED)

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END OF SECTION

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END OF SECTION

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SECTION 22 05 00
COMMON WORK RESULTS FOR PLUMBING

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Base Bid: It is the intent of these specifications to provide complete and workable plumbing systems as shown on the accompanying plans and as specified herein except such parts as are specifically exempted herein. Provide all necessary supervision, coordination, labor, materials, equipment, fixtures, drayage, hoisting, tools, transportation, plant services and facilities, machinery and connections to utilities for the installation of complete and operable plumbing systems. If details or special conditions are required in addition to those shown on drawings, provide all material and equipment usually furnished with such systems or required to complete their installation, whether noted in plans and specification or not.

B. Materials and labor shall be new (unless noted otherwise), first class and workmanlike and shall be subject at all times to the A/E's inspections, tests and approval from the commencement until the acceptance of the completed work.

C. The layout shown on the drawings is diagrammatic but shall be followed as closely as other work will permit. The drawings provide design intent. The Contractor shall verify all dimensions at the site and be responsible for their accuracy.

D. Because of the scale of the Drawings, certain basic items, such as, pipe fittings, duct fittings, access panels, and sleeves, may not be shown. Where such items are required by Code or by other Sections, or where required for proper installation of the Work, such items shall be included, whether shown or not.

E. In the event of any inconsistencies between the specifications, drawings, contract documents, applicable laws, statutes, ordinances, building codes, rules and regulations, the contractor shall provide the better quality or greater quantity of work and comply with or conform its work to the most stringent legal or contractual requirements.

F. Changes from these drawings required to make this work conform to the building construction shall be made only with prior written approval of the Architect/Engineer. All proposed changes shall be shown on shop drawings. All measurements shall be verified by actual observation and all work shall fit in place meeting the approval of the Architect/Engineer.

G. Equipment Specification may not deal individually with minute items required, such as, components, parts, controls, and devices which may be required to produce the equipment performance specified or as required to meet the equipment warranties. Where such items are required to make the system operational, they shall be included by the supplier of the equipment at no additional cost, whether or not specifically called for.

1.02 SECTION INCLUDES

A. This section includes information common to two or more technical plumbing specification sections or items that are of a general nature, not conveniently fitting into other technical sections.

1. Submittals
2. Reference Standards
3. Quality Assurance
4. Lead Free Requirements
5. Guarantee
6. Work By Owner
7. Equipment Furnished By Others
8. Operation And Maintenance Instructions
9. Record Documents
10. Continuity Of Existing Services
11. Protection Of Finished Surfaces

12. Sealing And Firestopping
13. Off Site Storage
14. Regulatory Requirements
15. Certificates And Inspections
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18. Request And Certification For Payment
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24. Salvage Materials
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38. Sheeting, Shoring And Bracing
39. Dewatering
40. Rock Excavation
41. Surface Restoration

1.03 RELATED WORK

A. Applicable provisions of Division 1 govern work under this section.

B. This section applies to all Division 22 sections of plumbing.

1.04 SUBMITTALS

A. Submit shop drawings for equipment under each section per requirements listed in that section, as well as per Division 1.

B. Submit for all equipment and systems as indicated in the respective specification sections, marking each submittal with that specification section number. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in the contract documents. Failure to do this may result in the submittal(s) being returned to the Contractor for correction and resubmission. Do not submit hard copies of web pages. Failing to follow these instructions does not relieve the Contractor from the requirement of meeting the project schedule.

C. On request from the A/E, the successful bidder shall furnish additional drawings, illustrations, catalog data, performance characteristics, etc.

D. Submittals shall be grouped to include complete submittals of related systems, products, and accessories in a single submittal. Mark dimensions and values in units to match those specified. Include wiring diagrams of electrically powered equipment.

E. The submittals must be approved before fabrication is authorized.

F. Provide electronic copies of all submittals for review. Electronic submittals shall be sent to wi@henneman.com for review.

G. Before submitting electrically powered equipment, verify that the electrical power and control requirements for the equipment are in agreement with the motor starter schedule on the electrical drawings. Include a statement on the shop drawing transmittal to the architect/engineer that the equipment submitted and the motor starter schedule is in agreement or indicate any discrepancies.

H. Not more than two weeks after award of contract but before any shop drawings are submitted, contractor to submit the following plumbing system data sheet. List piping material type for each piping service on the project, ASTM number, schedule or pressure class, joint type, manufacturer and model number where appropriate. List valves and specialties for each piping service, fixture and equipment with manufacturer and model number. The approved plumbing system data sheet(s) will be made available to the owner's project representative for their use on this project.

Plumbing System Data Sheet:

Item	Pipe Service/Sizes	Manufacturer/Model No.	Remarks
Pipe			
Fittings			
Unions			
Valves			
Pipe Specialties			
Hangers & Supports			
Insulation			
Plumbing Specialties			
Plumbing Fixtures			
Plumbing Equipment			

I. Shop drawing submittals are to be bound, labeled, contain the project manual cover page and a material index list page showing item designation, manufacturer and additional items supplied with the installation. Submit for all equipment and systems as indicated in the respective specification sections, marking each submittal with that specification section number. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in the contract documents. Include wiring diagrams of electrically powered equipment.

J. Submit sufficient quantities of data sheets and shop drawings to allow the following distribution:

1. Operating and Maintenance Manuals 1 copy
2. Owner 1 copy
3. Architect/Engineer 1 copy

1.05 REFERENCE STANDARDS

A. Abbreviations of standards organizations referenced in this and other sections are as follows:

1. ABMA American Boiler Manufacturers Association
2. ACPA American Concrete Pipe Association
3. AGA American Gas Association
4. ANSI American National Standards Institute
5. AHRI Air Conditioning, Heating and Refrigeration Institute
6. ASME American Society of Mechanical Engineers
7. ASPE American Society of Plumbing Engineers

8. ASSE American Society of Sanitary Engineering
9. ASTM American Society for Testing and Materials
10. AWWA American Water Works Association
11. AWS American Welding Society
12. CISPI Cast Iron Soil Pipe Institute
13. CGA Compressed Gas Association
14. CS Commercial Standards, Products Standards Sections, Office of Eng. Standards Service, NBS
15. EPA Environmental Protection Agency
16. FS Federal Specifications, Superintendent of Documents, U.S. Government Printing Office
17. GAMA Gas Appliance Manufacturers Association
18. IAPMO International Association of Plumbing & Mechanical Officials
19. IEEE Institute of Electrical and Electronics Engineers
20. ISA Instrument Society of America
21. MICA Midwest Insulation Contractors Association
22. MSS Manufacturer's Standardization Society of the Valve & Fitting Industry, Inc.
23. NBS National Bureau of Standards
24. NEC National Electric Code
25. NEMA National Electrical Manufacturers Association
26. NFPA National Fire Protection Association
27. NSF National Sanitation Foundation
28. PDI Plumbing and Drainage Institute
29. STI Steel Tank Institute
30. UL Underwriters Laboratories Inc.

B. Standards referenced in this section:

1. ACI 614 Recommended Practice for Measuring, Mixing and Placing of Concrete
2. ASTM D1557 Standard Test Method for Moisture-Density Relations of Soils
3. ASTM E814 Standard Test Method for Fire Tests of Through-Penetration Fire Stops
4. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials
5. UL1479 Fire Tests of Through-Penetration Firestops
6. UL723 Surface Burning Characteristics of Building Materials

1.06 QUALITY ASSURANCE

A. Substitution of Materials: Refer to Division 1 for equals and substitutions.

1. Where the following conflicts with Division 1, the requirements of Division 1 shall govern.
2. If the Contractor wishes to submit an alternate to the named manufacturers for any equipment, he may submit a voluntary alternative minimum 7 days prior to bid, stating the manufacturer’s name, model number, written, detailed product data.
3. Where materials or equipment are specified by name the proposed material or equipment must be identical to the specified material or equipment in all characteristics of quality, function and serviceability, regardless of application in the Project and, in addition, when the Architect deems that aesthetic significance is important, the equal material or

equipment must be identical in all characteristics of visual appearance, design, color and texture. Any proposed equal shall be submitted to Architect/Engineer for prior approval, which Architect/Engineer may approve or disapprove in its sole discretion. Work performed or constructed with unapproved equals is at Contractor's risk and any required correction of work incorporating unapproved equals shall be at Contractor's sole cost and expense.

4. In all instances, Contractor shall assume full responsibility for proof of equality of the statute to the equipment hereinafter specified. All data and information necessary for proof of equality, function and space requirements shall be prepared and accompany the submittal of the substitution to the Architect/Engineer. Approval by the Architect/Engineer of equipment other than the specified does NOT relieve Contractor of this responsibility.

B. All products and materials used are to be new, undamaged, clean and in good condition. Existing products and materials are not to be reused unless specifically indicated.

C. Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings, or engineering parameters from those indicated on the contract documents, the contractor is responsible for all costs involved in integrating the equipment or accessories into the system, including, but not limited to, coordination with other trades and any required changes by other trades and for obtaining the intended performance from the system into which these items are placed.

1.07 LEAD FREE REQUIREMENTS

A. All materials that contact potable water shall be lead free. Lead free refers to the wetted surface of pipe, fittings and fixtures in potable water systems that have a weighted average lead content $\leq$0.25% per the Federal Safe Drinking Water Act as amended January 4th 2011 Section 1417.

B. This requirement applies to all of the subsequent Plumbing Specification Sections and Plumbing Drawings and supersedes any part or model number that may conflict with this requirement.

1.08 GUARANTEE

A. Refer to Division 1 for guarantees and warranties. In addition to the requirements in Division 1, this Contractor shall meet the following requirements.

B. In entering into a contract covering this work, the contractor accepts the specifications and guarantees that the work will be carried out in accordance with the requirements of this specification or such modifications as may be made under the contract documents.

C. Contractor further guarantees that the workmanship and material will be of the best procurable and that none but experienced workmen familiar with each particular class of work will be employed.

D. Contractor further guarantees to replace and make good at his own expense, including travel time, all defects, which may develop within 1 year after final payment and acceptance by the Architect/Engineer, due to faulty workmanship or material, upon, receipt of written notification from the Owner.

1.09 WORK BY OWNER

A. Asbestos abatement will be performed by the Owner under separate contract.

1.10 EQUIPMENT FURNISHED BY OTHERS

A. Receive, store and install equipment furnished by others. Make final connections as required for the completed project, including providing all necessary piping, valves, filters, backflow preventers, and other accessories, as may be required. Verify complete and updated list with General Contractor.

1.12 OPERATION AND MAINTENANCE INSTRUCTIONS

A. Refer to Division 1 for all operations and maintenance instructions.

B. In addition to the general content specified under Division 1 supply the following additional documentation:
   1. Copies of all approved submittals along with approval letters
   2. Records of tests performed a to certify compliance with system requirements
   3. Manufacturer's wiring diagrams for electrically powered equipment
   4. Certificates of inspection by regulatory agencies
   5. Valve schedules
   6. Lubrication instructions, including list/frequency of lubrication
   7. Parts lists for fixtures, equipment, valves and specialties
   8. Manufacturers' installation, operation and maintenance recommendations for fixtures, equipment, valves and specialties
   9. Additional information as indicated in the technical specification sections

1.13 RECORD DOCUMENTS

A. Refer to Division 1 for record documents.

B. In addition to the general content specified under Division, follow the following procedures.
   1. During the progress of the work, Contractor shall maintain a current (daily) record set of the drawings and specifications, indicating thereon all work installed at variance with such Contract Documents including, without limitation, work covered by Addenda, Field Work Orders, Change Orders and Engineers additional instructions, interpretations and clarification. All changes or deviations from the original layout of the work and all critical dimensions of buried or concealed work shall be recorded. It shall be Contractor's responsibility to assure that said record sets are complete, accurate and up-to-date, Engineer shall have the right to inspect and review such record sets.
   2. At the completion of the work, Contractor shall indicate on record sets all record changes and such additional details necessary or appropriate to provide a complete reference document for use by Engineer. If variations and details cannot be shown clearly thereon, the Contractor shall prepare supplemental drawings adequate to impart the information. The foregoing drawings collectively shall constitute the "Record" drawings for the work.
   3. All indication on "Record" drawings shall be executed in a legible manner at Contractor's cost, using methods and legend presentations compatible with the overall scheme of the record drawings with respect to scale, drawing sheet sizes and sequential indexing. All changes shall be marked clearly in red and clouded.
   4. Engineer may review Contractor's "Record" drawings and notify Contractor of observed discrepancies or deviations. Contractor shall promptly correct discrepancies, deviations or illegible markups at Contractor's expense and resubmit revised drawings for Engineer review.

1.14 CONTINUITY OF EXISTING SERVICES

A. Do not interrupt or change existing services without prior written approval from the Owner's Project Representative. When interruption is required, coordinate scheduling of down-time with the Owner to minimize disruption to his activities. Unless specifically stated, all work involved in interrupting or changing existing services is to be done during normal working hours.

B. Each Contractor shall be thoroughly familiar with existing systems which will affect and be affected by relocation of existing equipment and installation of new lines and equipment. Contractor shall plan installation of their work so that interruptions of services to any building or portion thereof will be a minimum and such interruptions shall occur only when system is not required, if possible. If not possible, each Contractor shall insure the operation of services by whatever means possible, such as, installing bypasses, capping of services or providing temporary service. Each interruption shall be for as short a duration as possible.

C. No extra costs will be paid to the Contractor for such outages which must occur outside of regular weekly working hours.

D. This Contractor shall restore any circuit interruption as a result of this work to proper operation as soon as possible. Note that institutional operations are on a seven day week schedule.

1.15 PROTECTION OF FINISHED SURFACES

A. Refer to Division 1.

1.16 SEALING AND FIRESTOPPING

A. Sealing and firestopping of sleeves/openings between piping, etc. and the sleeve or structural opening shall be the responsibility of the contractor whose work penetrates the opening. The contractor responsible shall hire individuals skilled in such work to do the sealing and fireproofing. These individuals hired shall normally and routinely be employed in the sealing and fireproofing occupation.

B. Contractor shall request current life safety drawings from Architect/Owner.

1.17 OFF SITE STORAGE

A. If payment will be requested for approved offsite stored material, then the Contractor shall complete an “Offsite Storage Agreement” which is available from the Owner. Prior approval by Owner’s personnel for offsite storage will be needed. No material will be accepted for offsite storage unless submittals for the material have been approved.

1.18 REGULATORY REQUIREMENTS

A. Comply with requirements of Wisconsin Administrative Code and local Authority Having Jurisdiction (AHJ) regarding materials and installation.

1.19 CERTIFICATES AND INSPECTIONS

A. Refer to Division 1 for permits, regulations, utilities and taxes.

B. Obtain and pay for all required local or State installation inspections except those provided by the Architect/Engineer in accordance with State code. Deliver originals of these certificates to the Owner. Include copies of the certificates in the Operating and Maintenance Instructions.

C. Coordinate and provide inspections as required by the Authority Having Jurisdiction over the site.

1.20 COORDINATION

A. Refer to Division 1 for coordination. In addition to the requirements specified under Division 1, the following requirements apply.

B. It shall be the responsibility of each Contractor to coordinate and consult with each other to determine space requirements and to determine that adequate space for servicing is provided for all equipment whether furnished by the Contractor or others. The General Contractor shall have final decision on all space priority conflicts among Contractors. All space priority conflicts shall be brought to the attention of the Architect/Engineer and Owner's Representative.

C. Each Contractor shall be thoroughly familiar with existing systems which will affect and be affected by relocation of existing equipment and installation of new lines and equipment. They shall plan installation of their work so that interruptions of services to any building or portion thereof will be a minimum, and such interruptions shall occur only when system is not required, if possible. If not possible, each Contractor shall insure the operation of services by whatever means possible, such as, installing bypasses, capping of services, or providing temporary service. Each interruption shall be for as short a duration as possible.

D. Cooperation among all Contractors shall be required. Any Work that is installed without cooperating or coordinating with other Contractors and is in conflict shall be removed and reinstalled at that particular Contractor's cost. No cost additions to the Project will be

considered due to a Contractor's lack of participation in the cooperation and coordination process. The following list of items of Work shall be the priority of order for all Contractors:

1. Structure
2. Recessed light fixtures
3. Gravity-flow systems for sanitary, storm, steam and steam condensate piping
4. Ductwork and appurtenances
5. Electrical and low voltage cable tray
6. Plumbing vent piping
7. Fire protection (sprinkler system)
8. HVAC piping
9. Medical gas piping
10. Gas piping, process piping and domestic water
11. Electrical conduit and low voltage conduit
12. Control air lines or conduit

E. The above list, in descending order, is the precedence assigned the Work items for space priority. Gravity-flow systems have first priority.

F. Exception: Plumbing lines below or behind plumbing fixtures shall have precedence over all other work. Electrical conduit above or below switchgear, panelboards and control panels shall have precedence over all other work. Do not install any fluid conveying piping over electrical or elevator equipment.

G. In the case of interconnection of the work of two or more contractors, verify at the site or on shop drawings all dimensions relating to such work. All errors due to the failure to so verify any such dimensions shall be promptly rectified.

H. Any installed work that is not coordinated and interferes with another contractor’s work shall be removed or relocated at the installing contractor’s expense.

I. Prior to start of Construction, General Contractor shall schedule a meeting with all Contractors responsible for work items listed above. The purpose of the meeting is to introduce the coordination program and determine its implementation in relation to the progress schedule.

J. At initial Coordination Meeting, Mechanical Contractor/Ventilating Contractor shall provide to General Contractor outline drawings at 1/4" scale indicating column centerlines, interior partition locations, and ceiling heights. General Contractor shall verify all information shown on these drawings and relay any changes in the information to the Ventilation Contractor to be reflected on the Drawings. Ventilating Contractor, with reference and consideration to the Structural, Heating, Electrical, Fire Protection, and Plumbing Drawings, shall draw to scale his proposed installation showing duct sizes, equipment layouts, and dimensions from column lines and from finished floors to bottom of ducts. Ductwork shall be maintained as tightly as possible to the underside of floor slabs and/or beams. For congested areas Ventilating Contractor shall, in addition, prepare Drawings in section view. During this phase of the program, it shall be the Electrical Contractor's responsibility to furnish Ventilating Contractor with recessed lighting installation and clearance requirements. This information shall be outlined on Drawings by Ventilating Contractor.

K. The ductwork layouts shall be produced in sequence as mandated by the Project Schedule. The earliest area indicated in the Schedule shall receive the first effort, etc.

L. When the Ductwork Drawings for the earliest scheduled area have been completed (time limitation as determined at the initial coordination meeting), the Ventilating Contractor shall provide the General Contractor with one set of drawings for each participant in the effort. The General Contractor will distribute the drawings to the participating Contractors for their use in

drawing thereon the major components of their proposed installation using the general scheme shown on the Contract Drawings as a guide.

M. The major components to be indicated include (but are not limited to) the following:
   1. Structure
   2. Roof drain leaders
   3. Above 3” waste piping
   4. Sprinkler mains
   5. Heating hot water mains
   6. Chilled water mains
   7. Conveying systems
   8. Significant conduit runs
   9. Cable trays
   10. Contract ceiling heights
   11. Soffits
   12. Access points
   13. Fire wall penetrations
   14. Steam and condensate mains
   15. Gas, water, and process piping

N. Information delineated shall be distance from column centerlines, pipe/equipment size, and distance from finished floor to bottom of pipe/equipment and hangers. Included on the Drawings shall be piping layout with hanger locations and hanger point loads. This information shall be developed satisfactorily enough to allow Structural Engineer to verify the adequacy of the structural system for the projected loads. The hanger locations may have to be moved depending on the structural system review. No hanger shall be fabricated and/or installed until hanger locations are reviewed and accepted by Architect/Engineer.

O. Within a period not to exceed two weeks after distribution of the drawings, the General Contractor will schedule a meeting with the Architect/Engineer and participating Contractors at which time areas of conflict shall be resolved. The drawings shall be overlaid to identify areas of conflict. All parties shall then cooperate in resolving the conflicts. Records of the agreements shall be entered on the Ventilating Contractor's drawings, acknowledged by all participants by signature in space provided for this purpose, and two copies distributed to all involved parties. All coordination drawing preparation and reproduction costs shall be borne by the Ventilating Contractor. The above drawings, review, and coordination process shall be repeated until all areas on the Project have been coordinated.

P. In the event a Contractor fails to cooperate in the Coordination Program, they shall be held responsible for all costs incurred for adjustments to the work of others made necessary to accommodate the uncooperative Contractor's installations.

1.21 DEMOLITION AND EXISTING REQUIREMENTS

A. Existing active services: water, gas, medical gas, steam, ventilation, compressed or control air, sanitary waste, sanitary vent, storm electric, and any other building systems when encountered shall be protected against damage. Where existing services are to be abandoned, the services shall be removed back to the point of origin and removed from the site unless otherwise directed by the Owner's Representative.

B. Submit a “Sequence of Work Schedule” in respect to all temporary and permanent utility and service cutovers after final determination. This schedule shall be submitted for approval to the Owner and Architect/Engineer. The submittal shall designate priority order, service or utility affected, date of cutover, and time of day to start and finish.

C. Bidders should inspect the site to become familiar with conditions of the site which will affect the Work. Bidders should verify points of connection with utilities, routing of outside piping to include required clearances from any existing structures, or other obstacles.

D. Extra payment will not be allowed for changes in the Work required because of the successful bidder's failure to make this inspection.

1.22 REQUEST AND CERTIFICATION FOR PAYMENT

A. Within 10 days after Notice to Proceed, the successful bidder will submit to the Owner's Project Representative in a form prescribed by Division 1, a cost breakdown of the proposed values for work performed which, if approved by the owner, will become the basis for construction progress and monthly payments. The cost breakdown items shall reflect actual work progress stages as closely as feasible.

B. In addition, if payment is requested for approved off-site stored material, then that material shall be listed as a line item in the request and certification for payment cost breakdown.

1.23 SLEEVES AND OPENINGS

A. Openings required in new or existing construction that may be necessary for the installation of new work shall be provided by the respective contractor and all patching and repairing shall be done by workmen competent in the trade required, at the expense of the respective contractor. The respective contractor shall be responsible for arranging the work so that minimum cutting will be required. All rubbish and excess materials involved in such cutting shall be promptly removed from the site and disposed of by the contractor. Cutting through the floor or roof systems or load bearing walls shall be done only with the prior written approval of the Architect/Engineer so as to avoid damaging the structural system.

1.24 OMISSIONS

A. No later than ten (10) days before bid opening, the Contractor shall call the attention of the A/E to any materials or apparatus the Contractor believes to be inadequate and to any necessary items of work omitted.

1.25 DEFINITIONS

A. Wherever the words "the Contractor", "this Contractor" or "Plumbing Contractor" appear in this division, they refer to the Contractor for Plumbing work.

B. The term "provide" includes such labor, methods, materials, equipment and transportation or other facilities required to complete the Contract and the performance of all duties thereby upon the Contractor.

1.26 PROJECT/SITE CONDITIONS

A. Install Work in locations shown on Drawings, unless prevented by Project conditions.

B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of A/E before proceeding.

C. Tools, materials and equipment shall be confined to areas designated by the Owner's project representative.

1.27 WORK SEQUENCE AND SCHEDULING

A. Install work in phases to accommodate Owner's occupancy requirements. During the construction period coordinate schedule and operations with Owner's Construction Representatives.

1.28 SALVAGE MATERIALS

A. No materials removed from this project shall be reused (except as specifically noted below). All materials removed shall become the property of and shall be disposed of by the Contractor.

1.29 TRAINING

A. The contractor shall have the following responsibilities:
   1. Provide a training plan sixty days before the planned training covering the following elements:
      a. Equipment
      b. Intended audience
      c. Location of training
      d. Objectives
      e. Subjects covered (description, duration of discussion, special methods, etc.)
      f. Duration of training on each subject
      g. Instructor for each subject
      h. Methods (classroom lecture, manufacturer's quality video, site walk-through, actual operational demonstrations, written handouts, etc.)
   2. Provide designated owner personnel with comprehensive orientation and training in the understanding of the systems and the operation and maintenance of each piece of equipment that makes up the system.
   3. Training shall normally start with classroom sessions followed by hands-on demonstration/training on each piece of equipment.
   4. During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system shall be repaired or adjusted as necessary and the demonstration repeated at another scheduled time, if necessary.
   5. The appropriate trade or manufacturer's representative shall provide the instructions on each major piece of equipment. Practical building operating expertise as well as in-depth knowledge of all modes of operation of the specific piece of equipment are required. More than one party may be required to execute the training.
   6. The controls contractor shall attend sessions other than the controls training, as specified, to discuss the interaction of the controls system as it relates to the equipment being discussed.
   7. The training sessions shall follow the outline in the table of contents of the operation and maintenance manual and illustrate whenever possible the use of the O&M manuals for reference.
   8. Training shall include:
      a. Use of the printed installation, operation and maintenance instruction material included in the O&M manuals.
      b. A review of the written O&M instructions emphasizing safe and proper operating requirements, preventative maintenance, special tools needed and spare parts inventory suggestions. The training shall include startup, operation in all modes possible, shutdown, seasonal changeover and any emergency procedures.
      c. Discussion of relevant health and safety issues and concerns.
      d. Discussion of warranties and guarantees.
      e. Common troubleshooting problems and solutions.
      f. Explanatory information included in the O&M manuals.
      g. Discussion of any peculiarities of equipment installation or operation.
      h. Classroom sessions shall include the use of overhead projections, slides, video/audio-taped material as might be appropriate.

i. Hands-on training shall include startup, operation in all modes possible, including manual, shut-down, alarms, power failure and any emergency procedures, and preventative maintenance for all pieces of equipment.

9. The contractor shall fully explain and demonstrate the operation, function and overrides of any local packaged controls not controlled by the central control system.

B. Video recording of the training sessions will be provided by the contractor and added to the O&M manuals. In addition, factory training videos identifying key troubleshooting, repair, service and/or replacement techniques shall be provided and reviewed with the owner.

C. Provide a minimum of 8 hours of instruction.

D. Provide additional training as specified in other specification sections for specific equipment.

PART 2 – PRODUCTS

2.01 ACCESS PANELS AND DOORS

A. Lay-in Ceilings:

1. Removable lay-in ceiling tiles in 2 X 2 foot or 2 X 4 foot configuration provided under Division 9 are sufficient; no additional access provisions are required unless specifically indicated.

B. Plaster Walls and Ceilings:

1. 16 gauge frame with not less than a 20 gauge hinged door panel, prime coated steel for general applications, stainless steel for use in toilets, showers, and similar wet areas, concealed hinges, screwdriver operated cam latch for general applications, key lock for use in public or secured areas, UL listed for use in fire rated partitions if required by the application. Use the largest size access opening possible, consistent with the space and the item needing service; minimum size is 12" by 12".

2.02 IDENTIFICATION

A. Manufacturers: EMED Company, W.H. Brady, Seton Nameplate Company, Thor Enterprises, Carlton, MSI Marking Services.

B. Engraved Name Plates:

1. White letters on a black background, 1/16 inch thick plastic laminate, beveled edges, screw mounting.

C. Snap-Around Pipe Markers:

1. One-piece, preformed, vinyl construction, snap-around or strap-around pipe markers with applicable labeling and flow direction arrows, ¾" min. size for lettering. Provide nylon ties on each end of pipe markers.

D. Valve Tags:

1. Round brass tags with 1/2 inch numbers, 1/4 inch system identification abbreviation, 1-1/4 inch minimum diameter, with brass jack chains, brass "S" hooks or one piece nylon ties around the valve stem.

E. Underground Warning Tape:

1. Detectable underground warning tape, 5.0 mil overall thickness, 6" width, .0035" thick aluminum foil core with polyethylene jacket bonded to both sides. Color code tape and print caution along with name of buried service in bold letters on face of tape.

2. Underground Tracer Wire:

3. All underground non-metallic sewers/mains and water services/mains shall be provided with tracer wire installations. Tracer wire shall be continuous solid copper or steel plastic coated with split bolt or compression-type connectors.

2.03 BEDDING AND BACKFILL

A. Bedding up to a point 12" inches above the top of the pipe shall be thoroughly compacted sand or crushed stone chips meeting the following gradations:

Gradation for Bedding Sand		Gradation for Crushed Stone Chip Bedding	
Sieve Size	% Passing (by Wt.)	Sieve Size	% Passing (by Wt.)
1 inch	100	1/2 inch	100
No. 16	45 - 80	No. 4	75 - 100
No. 200	2 - 10	No. 100	10 - 25

B. Backfill above the bedding in lawn areas shall be thoroughly compacted excavated material free of large stones, organic, perishable, and frozen materials.

C. Backfill above the bedding under existing and future utilities, paving, sidewalks, curbs, roads and buildings shall be granular materials, pit run sand, gravel, or crushed stone, free from large stones, organic, perishable and frozen materials.

2.04 SLEEVES AND OPENINGS

A. General:

1. Pipe sleeves shall be constructed of standard weight ASTM A53 or ASME B36.10 steel with an anchor plate constructed of A36/A36M steel welded to the pipe. The sleeve shall be sized a minimum of 1” larger than piping insulation diameter. The entire assembly shall be hot-dip galvanized after fabrication.
2. Duct sleeves and piping sleeves passing through interior walls shall be constructed of 24 gauge galvanized steel minimum thickness.

B. Sleeves Through Below Grade Walls:

1. Provide steel pipe sleeve, ASTM A53, pressure sealing with membrane clamp ring, gasket, water stop ring, external rings, and nitrile rubber link seals. The assembly shall be hot-dip galvanized after fabrication.
   a. Seals: Modular mechanical type seals, consisting of interlocking nitrile rubber links shaped to continuously fill the annular space between the pipe and the sleeve and electrically isolate the carrier pipe from the steel sleeve.
   b. Sealing Element: Polychloroprene rubber material compounded to resist aging, ozone, sunlight, hydrocarbon gases, water, and chemical action.
   c. Hardware: Type 300 series stainless steel fasteners. Threads rolled to produce smooth uniform threads and unbroken flow lines.
   d. Compression Plates: Fiberglass-reinforced polyester plastic, injection molded for high physical properties, dielectric strength and non-cold flow creep characteristics, having high resistance to acidic and alkaline soils.
2. For sleeves located 15 feet or more below grade provide cast iron sleeve ASTM A74 with compression seals.

2.05 SEALING AND FIRESTOPPING

A. Fire and/or Smoke Rated Penetrations:

1. Manufacturers: 3M, Hilti, Rectorseal, STI/SpecSeal, Tremco.
2. All firestopping systems shall be provided by the same manufacturer.
3. Fire stop systems shall be UL listed or tested by an independent testing laboratory approved by the Owner and the Authority Having Jurisdiction (AHJ).
4. Submittals: Contractor shall submit product data for each firestop system. Submittals shall include product characteristics, performance and limitation criteria, test data, MSDS sheets, installation details and procedures for each method of installation applicable to this project. For non-standard conditions where no UL tested system exists, submit

manufacturer's drawings for UL system with known performance for which an engineering judgment can be based upon.

5. Use a product that has a rating not less than the rating of the wall or floor being penetrated. Reference architectural drawings for identification of fire and/or smoke rated walls and floors.
6. Use firestop putty, caulk sealant, intumescent wrapstrips, intumescent firestop collars, firestop blocks, firestop mortar or a combination of these products to provide a UL listed system for each application required for this project. Provide mineral wool backing where specified in manufacturer's application detail.
7. All sealants shall meet the intent of LEED® VOC requirements, <250 g/L VOC contents (less H_20 and exempt solvents).

B. Non-Rated Penetrations:

1. Pipe Penetrations Through Below Grade Walls: In exterior wall openings below grade, use a modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the uninsulated pipe and the cored opening or a water-stop type wall sleeve. The operating bolts of the mechanical type seal shall be accessible from the interior of the building.
2. Pipe Penetrations: At pipe penetrations of non-rated interior partitions, floors and exterior walls, use urethane caulk in annular space between pipe insulation and sleeve. For non-rated drywall, plaster or wood partitions where sleeve is not required use urethane caulk in annular space between pipe insulation and wall material.

PART 3 – EXECUTION

3.01 DEMOLITION

A. Perform all demolition as indicated on the drawings to accomplish new work. Where demolition work is to be performed adjacent to existing work that remains in an occupied area, construct temporary dust partition to minimize the amount of contamination of the occupied space. Where pipe is removed and not reconnected with new work, cap ends of existing services as if they were new work. Coordinate work with the Owner to minimize disruption to the existing building occupants.

B. All pipe, fixtures, equipment, wiring and associated conduit, insulation and similar items demolished, abandoned, or deactivated are to be removed from the site by the Contractor except as specifically noted otherwise. All designated equipment is to be turned over to the owner for their use at a place and time so designated. Maintain the condition of material and/or equipment that is indicated to be reused equal to that existing before work began.

C. All contractors requiring the personnel/ material hoist and or temporary construction elevator (i.e. new elevators, temporarily protected) at times other than outlined in the temporary facilities specifications will make arrangements directly with the general contractor. The general contractor is responsible for all coordination and scheduling of the use of any hoisting equipment so the flow of the project is smoothly maintained and all workers have access to the work areas to perform their work and deliver material to the areas needed according to the project schedule.

D. If any contractor’s work requires the removal and replacement of any finished materials including but not limited to such materials as ceiling tiles, wall finishes, cabinets, doors, flooring, windows, etc. after those items are installed, each contractor will be responsible, at no additional cost to the owner, to replace any damaged, soiled or lost materials with new materials to match the existing materials and those materials damaged.

3.02 EXCAVATION AND BACKFILL

A. Perform all excavation and backfill work necessary to accomplish indicated plumbing systems installation. Excavate to bottom of pipe and structure bedding, 4" in stable soils, 6" in rock or wet trenches and 8" in unstable soil. Finish bottoms of excavations to true, level surface.

B. Tunnel or remove sidewalk and curb in areas of excavation to the nearest joint. Remove pavements, curbs and gutters to neat and straight lines to the limits of removal. Make sawcut lines parallel to existing joints, or parallel or perpendicular to pavement edges to form a neat patch. Carefully remove remaining pavement within the sawcut area. Leave existing base materials between the area disturbed by the work and the sawcut line undisturbed by the sawcutting, pavement removal, or pavement replacement processes.

C. Strip topsoil from area to be excavated, free from subsoil and debris, and store for later respreading.

D. At no time place excavated materials where they will impede surface drainage unless such drainage is being safely rerouted away from the excavation.

E. Excavate whatever materials are encountered as required to place at the elevations shown, all pipe, manholes, and other work. Remove debris and rubbish from excavations before placing bedding and backfill material.

F. Remove surplus excavated materials from site.

G. Verify the locations of any water, drainage, gas, sewer, electric, telephone or steam lines which may be encountered in the excavation. Underpin and support all lines. Cut off service connections encountered which are to be removed at the limits of the excavation and cap.

H. Provide and maintain all fencing, barricades, signs, warning lights, and/or other equipment necessary to keep all excavation pits and trenches and the entire subgrade area safe under all circumstances and at all times. No excavation shall be left unattended without adequate protection.

I. Elevations shown on the plans are subject to such revisions as may be necessary to fit field conditions. No adjustment in compensation will be made for adjustments up to two (2) feet above or below the grades indicated on the plans.

J. Install lines passing under foundations with minimum of 1-1/2 inch clearance to concrete and insure there is no disturbance of bearing soil.

K. Bed pipe up to a point 12" above the top of the pipe. Take care during bedding, compaction and backfill not to disturb or damage piping.

L. Mechanically compact bedding and backfill to prevent settlement. The initial compacted lift to not exceed 24" compacted to 95% density per Modified Proctor Test (ASTM D-1557). Subsequent lifts under pavements, curbs, walks and structures are not to exceed 12" and be compacted to 95% density per Modified Proctor Test. In all other areas where construction above the excavation is not anticipated within 2 years, mechanically compact backfill in lifts not exceeding 24" to 90% density per Modified Proctor Test. Route the equipment over each lift of the material so that the compaction equipment contacts all areas of the surface of the lift.

3.03 CONCRETE WORK

A. Cast-in-place concrete within the building will be performed by the Division 3 Contractor unless otherwise noted. Provide all layout drawings, anchor bolts, metal shapes, and/or templates required to be cast into concrete or used to form concrete for support or installation of plumbing piping, fixtures, specialties and equipment. Coordinate locations of equipment, pipe penetrations in wet areas, etc. with the Division 3 Contractor.

B. Plumbing related cast-in-place concrete on the exterior of the building to be provided by this Contractor in conformance with requirements of Division 3. This includes piping thrust restraints, pipe supports, hydrant supports, manholes, catch basins, grease traps, septic tanks, distribution boxes, valve pits, meter pits, cleanout cover pads, yard hydrant pads, etc.

3.04 CUTTING AND PATCHING

A. Refer to Division 1 for cutting and patching. In addition to the requirements in Division 1:

B. Each Contractor shall coordinate the placing of openings in the new structure as required for the installation of each Contractor's work.

C. Each Contractor shall furnish to the General Contractor the accurate locations and sizes for required openings in the new work, but this shall not relieve each Contractor of the responsibility of checking to assure that properly sized openings are provided. When additional patching is required due to the Contractor's failure to inspect this work, then the Contractor shall make arrangements for the patching required to properly close the openings to include patch painting, and the Contractor shall pay any additional cost incurred in this respect.

D. If cutting and patching of the new structure is made necessary due to the Contractor's failure to install piping, ducts, sleeves, or equipment on schedule, or due to the Contractor's failure to furnish on schedule the information required for the leaving of openings, then it shall be the Contractor's responsibility to make arrangements and obtain approval from the General Contractor and Architect/Engineer for this cutting and patching, and the Contractor shall pay any additional cost incurred in this respect. The Contractor shall also reimburse the Owner for any additional costs incurred to the Architect/Engineer for additional services caused by the Contractor in this respect.

E. The Contractor shall provide cutting and patching and patch painting in the existing structure as required for the installation of his Work and shall furnish lintels and supports as required for openings. Cutting of structural support members will not be permitted without prior approval of the Architect/Engineer. Extent of cutting shall be minimized; use core drills, power saws, or other machines which will provide neat, minimum openings. Patching shall match adjacent materials and surfaces and shall be performed by craftsmen skilled in the respective craft required.

3.05 LINTELS

A. All steel lintels required for opening in existing and/or new masonry walls shall be provided under section 05 50 00 – Metal Fabrications. This contractor shall design, fabricate, and install all lintels required in masonry walls for duct and pipe penetrations. Contractor shall submit design drawings of lintels with professional engineers seal and signature prior to installation.

3.06 BUILDING ACCESS

A. Arrange for the necessary openings in the building to allow for admittance or removal of all apparatus. When the building access was not previously arranged and must be provided by this contractor, restore any opening to its original condition after the apparatus has been brought into the building.

3.07 EQUIPMENT ACCESS

A. Install all piping, conduit and accessories to permit access to equipment for maintenance and service. Coordinate the exact location of wall and ceiling access panels and doors with the General Contractor, making sure that access is available for all equipment and specialties. Access doors in general construction are to be furnished by the Plumbing Contractor and installed by the General Contractor.

B. Provide color coded thumb tacks or screws, depending on the surface, for use in accessible ceilings which do not require access panels.

3.08 COORDINATION

A. Coordinate all work with other contractors prior to installation. Any work that is not coordinated and that interferes with other contractor's work shall be removed or relocated at the installing contractor's expense.

B. Verify that all devices are compatible for the type of construction and surfaces on which they will be used.

3.09 IDENTIFICATION

A. Identify interior piping not less than once every 30 feet, not less than once in each room, adjacent to each access door or panel, and on both side of the partition where accessible

piping passes through walls or floors. Place flow directional arrows at each pipe identification location.

B. Identify all exterior buried piping for entire length with underground warning tape except for sewer piping which is routed in straight lines between manholes or cleanouts. Place tape 6"-12" below finished grade along entire length of pipe. Extend tape to surface at building entrances, meters, hydrants and valves. Where existing underground warning tape is broken during excavation, replace with new tape identifying appropriate service and securely spliced to ends of existing tape.

C. Identify valves with brass tags bearing a system identification and a valve sequence number. Identify medical gas and vacuum valves with brass tags and wall or cabinet mounted color coded engraved nameplate with the following "(Type of Gas) Shutoff Valve for (Location or Zone)". Valve tags are not required at a terminal device unless the valves are greater than ten feet from the device, located in another room or not visible from device. Provide a typewritten valve schedule and pipe identification schedule indicating the valve number and the equipment or areas supplied by each valve and the symbols used for pipe identification; locate schedules in mechanical room and in each Operating and Maintenance manual. Schedule in mechanical room to be framed under clear plastic.

3.10 LUBRICATION

A. Lubricate all bearings with lubricant as recommended by the manufacturer before the equipment is operated for any reason. Once the equipment has been run, maintain lubrication in accordance with the manufacturer's instructions until the work is accepted by the Owner. Maintain a log of all lubricants used and frequency of lubrication; include this information in the Operating and Maintenance Manuals at the completion of the project.

3.11 SLEEVES AND OPENINGS

A. General:

1. Sleeves are not required for piping and ducts passing through interior non-rated drywall, plaster, or wood partitions and interior poured concrete walls that have been saw cut or core drilled.
2. Pack annular space between sleeves and pipe or ducts with fiberglass insulation and seal.
3. Piping sleeves that pass through fire rated floors, walls, or ceilings shall be provided with a UL listed fire stop material meeting UL 1479 to seal the opening between the pipe and the pipe sleeve to maintain the fire rating.
4. Provide escutcheon plates on piping to cover sleeve and insulation in finished areas.
5. Refer to Division 1, General Requirements for additional information on sleeves and openings.

B. Sleeves Through Floors/Ceilings:

1. Sleeves shall be installed to extend 1 inch above finished floor with a watertight sealant between floor and sleeve in all mechanical rooms and wet rooms listed below.
2. If a sleeve is not provided, provide 1-1/2 inch angle ring with urethane caulk between the angle and the floor and seal at the corners to form a watertight seal.
   a. Wet Locations:
      1) Mechanical Rooms
      2) Sanitary pumping stations
      3) Food service/kitchen areas (behind/under equipment, cabinets, tables, etc.)

3.12 SEALING AND FIRESTOPPING

A. The Contractor shall refer to building life safety drawings for all smoke and fire rates in addition to the mechanical drawings. Any discrepancies shall be brought to the attention of the Architect/Engineer before final addendum.

B. Fire and/or Smoke Rated Penetrations:

1. Install approved product in accordance with the manufacturer's instructions where pipes penetrate a fire/smoke rated surface. When pipe is insulated, use a product which maintains the integrity of the insulation and vapor barrier.

2. Where firestop mortar is used to infill large fire-rated floor openings that could be required to support weight, provide permanent structural forming. Firestop mortar alone is not adequate to support any substantial weight.

C. Non-Rated Partitions:

1. In exterior wall openings below grade, assemble rubber links of mechanical seal to the proper size for the pipe and tighten in place, in accordance with manufacturer's instructions.

2. At all interior partitions and exterior walls, pipe penetrations are required to be sealed. Apply sealant to both sides of the penetration in such a manner that the annular space between the pipe sleeve or cored opening and the pipe or insulation is completely blocked.

3.13 HOUSEKEEPING AND CLEAN UP

A. The Contractor shall clean up and remove from the premises, on a daily basis, all debris and rubbish resulting from its work and shall repair all damage to new and existing equipment resulting from its work. When job is complete, this Contractor shall remove all tools, excess material and equipment, etc., from the site.

3.14 SHEETING, SHORING AND BRACING

A. Provide shoring, sheet piling and bracing in conformance with the Building Code to prevent earth from caving or washing into the excavation. Shore and underpin to properly support adjacent or adjoining structures. Abandon in place shoring, sheet piling and underpinning below the top of the pipe, or, if approved in advance by the engineer, maintained in place until other permanent support approved by the engineer is provided.

3.15 DEWATERING

A. Provide, operate and maintain all pumps and other equipment necessary to drain and keep all excavation pits, trenches and the entire subgrade area free from water under all circumstances. Obtain well permit from the Wisconsin Department of Natural Resources district office for dewatering wells discharging more than 70 GPM. Comply with permit requirements.

3.16 ROCK EXCAVATION

A. Remove rock encountered in the excavation to a minimum dimension of six (6) inches outside the pipe. Rock excavation includes all hard, solid rock in ledges, bedded deposits and unstratified masses, all natural conglomerate deposits so firmly cemented as to present all the characteristics of solid rock, which material is so hard or so firmly cemented that in the opinion of the Engineer it is not practical to excavate and remove same with a power shovel except after thorough and continuous drilling and blasting. Rock excavation includes rock boulders of 1/2 cubic yard or more in volume.

B. Rock excavation will be computed on the basis of the depth of rock removed and a trench width two (2) feet larger than the outside diameter of the pipe where one (1) pipe is laid in the trench and three (3) feet larger than the combined outside diameter where two (2) pipes are laid in the trench. Include 6" pipe and structure bedding in rock excavation. Include rock excavation shown on the plans in the Base Bid.

3.17 SURFACE RESTORATION

A. Completely restore the surface of all disturbed areas to a like condition of the surface prior to the work. Level off all waste disposal areas and clean up all areas used for the storage of

materials or the temporary deposit of excavated earth. Remove all surplus material, tools and equipment.

B. Lawns: Topsoil with 4" of clean, friable, fertile topsoil, free from debris, lumps, rocks, roots, plants and seeds. Grade surfaces to match adjacent elevations. Rake smooth, free of lumps and debris. Sod with good quality nursery sod, uniform, dense, free from weeds and consisting of approximately 60% Kentucky blue grass and the balance perennial rye, fescue and white clover. Place sod with joints staggered and abutting. Maintain lawn areas for one month after installation. Contractor will be responsible for necessary watering and mowing. Do necessary weeding, repair, reseeding or resodding until uniform catch is obtained.

C. Curb and Gutter: Concrete curb and gutter conforming to local requirements.

D. Sidewalk and Walkways: Non-reinforced concrete conforming to local requirements, thickness to match existing, cross slope of one-fourth inch per foot, scored into squares approximately equal to width.

E. Bituminous Concrete Pavements: 4" thick crushed stone base course and two pass bituminous concrete pavement, first course 1-1/2" binder, second course 1-1/2" surface.

END OF SECTION

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SECTION 22 05 13

COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Base Bid: Unless noted otherwise, the Plumbing Contractor shall provide all labor and materials for a complete system in this specification section.

1.02 SECTION INCLUDES

A. This section includes requirements for single and three phase motors that are used with equipment specified in other sections.

1. Single Phase, Single Speed Motors
2. Electronically Commutated Motors

1.03 RELATED WORK

A. Applicable provisions of Division 1 govern work under this section.

B. Section 22 30 00 – Plumbing Equipment for equipment requiring motors.

C. Section 22 42 00 – Commercial Plumbing Fixtures.

D. Division 26 – Electrical – Electrical for power wiring, starters, and other electrical devices

1.04 SUBMITTALS

A. Refer to Section 22 05 00 – Common Work Results for Plumbing, Submittals. In addition to the general content specified under Section 22 05 00 – Common Work Results for Plumbing, supply the following submittals:

1. Single Phase, Single Speed Motors
2. Electronically Commutated Motors

B. Include with the equipment which the motor drives the following motor information: motor manufacturer, voltage, phase, hertz, rpm, full load efficiency, full load power factor, service factor, NEMA design designation, insulation class, and frame type.

1.05 REFERENCE STANDARDS

A. ANSI/IEEE 112 Test Procedure for Polyphase Induction Motors and Generators

B. ANSI/NEMA MG-1 Motors and Generators

C. ANSI/NFPA 70 National Electrical Code

1.06 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified in Section 22 05 00 – Common Work Results for Plumbing.

1.07 ELECTRICAL COORDINATION

A. All starters, disconnects, relays, wire, conduit, pushbuttons, pilot lights, and other devices required for the control of motors or electrical equipment are provided by the Electrical Contractor, except as specifically noted elsewhere in this division of specifications.

B. Electrical drawings and/or specifications show number and horsepower rating of all motors furnished by this Contractor, together with their actuating devices if these devices are furnished by the Electrical Contractor. Should any discrepancy in size, horsepower rating, electrical characteristics or means of control be made to any motor or other electrical equipment after contracts are awarded, Contractor is to immediately notify the architect/engineer of such discrepancy. Costs involved in any changes required due to equipment substitutions initiated by this contractor will be the responsibility of this contractor.

C. The A/E must coordinate specified voltages with the Electrical Consultant for the project. The Electrical Contractor will provide all power wiring and the Plumbing Contractor will provide all control wiring. Control wiring shall conform to Division 16 requirements for Control Wiring.

D. Furnish project specific wiring diagrams to Electrical Contractor for all equipment and devices furnished by this Contractor and indicated to be wired by the Electrical Contractor.

1.08 PRODUCT CRITERIA

A. Motors to conform to all applicable requirements of NEMA, IEEE, ANSI, and NEC standards and shall be listed by U.L. for the service specified.

B. Select motors for conditions in which they will be required to perform; i.e., general purpose, splashproof, explosion proof, standard duty, high torque or any other special type as required by the equipment or motor manufacturer's recommendations.

C. Furnish motors for starting in accordance with utility requirements and compatible with starters as specified.

PART 2 – PRODUCTS

2.02 SINGLE PHASE, SINGLE SPEED MOTORS

A. Use NEMA rated 115 volt, single phase, 60 hertz motors for all motors 1/3 HP and smaller.

B. Use permanent split capacitor or capacitor start, induction run motors equipped with permanently lubricated and sealed ball or sleeve bearings and Class A insulation. Service factor to be not less than 1.35.

2.03 ELECTRONICALLY COMMUTATED MOTORS

A. Use NEMA rated 115 volt, single phase, 60 hertz motors for all motors 1/3 HP and smaller, low in-rush current.

B. UL 778 listed, electronically commutated permanent magnet motor (ECM/PM) technology, wet rotor equipped with permanently lubricated and sealed bearings.

C. Motors shall include Class F insulation.

D. Motors shall comply with NEMA Type 2 enclosure, on-board electronically thermally protected.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Mount motors on a rigid base designed to accept a motor, using shims if required under each mounting foot to get a secure installation.

B. When motor will be flexible coupled to the driven device, mount coupling to the shafts in accordance with the coupling manufacturer's recommendations. Using a dial indicator, check angular misalignment of the two shafts; adjust motor position as necessary so that the angular misalignment of the shafts does not exceed 0.002 inches per inch diameter of the coupling hub. Again using the dial indicator, check the shaft for run-out to assure concentricity of the shafts; adjust as necessary so that run-out does not exceed 0.002 inch.

C. When motor will be connected to the driven device by means of a belt drive, mount sheaves on the appropriate shafts in accordance with the manufacturer's instructions. Use a straight edge to check alignment of the sheaves; reposition sheaves as necessary so that the straight edge contacts both sheave faces squarely. After sheaves are aligned, loosen the adjustable motor base so that the belt(s) can be added and tighten the base so that the belt tension is in accordance with the drive manufacturer's recommendations. Frequently recheck belt tension and adjust if necessary, during the first day of operation and again after several days.

D. Verify the proper rotation of each three-phase motor as it is being wired or before the motor is energized for any reason.

E. Lubricate all motors requiring lubrication.

END OF SECTION

SECTION 22 05 14
PLUMBING SPECIALTIES

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Base Bid: Unless noted otherwise, the Plumbing Contractor shall provide all labor and materials for a complete system in this specification section.

1.02 SECTION INCLUDES

A. This section includes specifications for floor drains, roof drains, cleanouts, backflow preventers, water hammer arrestors and other miscellaneous plumbing specialties.

1. Floor Drains
2. Hub Drains
3. Roof Drains
4. Cleanouts
5. Backwater Valves
6. Water Hammer Arrestors
7. Backflow Preventers
8. Wall Hydrants
9. Hose Bibbs
10. Trap Guards
11. Safings
12. Vent Flashings
13. Wall Boxes
14. Solids Interceptors

1.03 RELATED WORK

A. Applicable provisions of Division 1 shall govern work under this section.

B. Section 22 05 23 – General-Duty Valves for Plumbing Piping

C. Section 22 11 00 – Facility Water Distribution

D. Section 22 13 00 – Facility Sanitary Sewerage

E. Section 22 14 00 – Facility Storm Drainage

1.04 SUBMITTALS

A. Refer to Section 22 05 00 – Common Work Results for Plumbing. In addition to the general content specified under Section 22 05 00 – Common Work Results for Plumbing, supply the following submittals:

1. Floor Drains
2. Hub Drains
3. Roof Drains
4. Cleanouts
5. Backwater Valves
6. Water Hammer Arrestors
7. Backflow Preventers
8. Wall Hydrants

9. Hose Bibbs
10. Trap Guards
11. Safings
12. Vent Flashings
13. Wall Boxes
14. Solids Interceptors

B. Include data concerning dimensions, capacities, materials of construction, ratings, certifications, weights, manufacturer's installation requirements, manufacturer's performance limitations, and appropriate identification.

1.05 REFERENCE STANDARDS

A. ANSI A112.14.1 - Backwater Valves.
B. ANSI A112.21.1 - Floor Drains.
C. ANSI A112.21.2 - Roof Drains.
D. ANSI A112.26.1/PDI WH-201 - Water Hammer Arrestors.
E. ASSE 1001 - Pipe Applied Atmospheric Type Vacuum Breakers.
F. ASSE 1010 - Water Hammer Arrestors.
G. ASSE 1011 - Hose Connection Vacuum Breakers.
H. ASSE 1012 - Backflow Preventers with Intermediate Atmospheric Vent.
I. ASSE 1013 - Reduced Pressure Principle Backflow Preventers.
J. ASSE 1017 - Temperature Activated Mixing Valves For Hot Water Distribution Systems.
K. ASSE 1018 - Trap Seal Primer Valves.
L. ASSE 1019 - Wall Hydrants, Frost Proof Automatic Draining, Anti-Backflow Type.

1.06 QUALITY ASSURANCE

A. Substitution of Materials: Refer to Division 1.
B. Plumbing products requiring approval by the State of Wisconsin Dept. of Safety & Professional Services must be approved or have pending approval at the time of shop drawing submission.

1.07 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified in Section 22 05 00 – Common Work Results for Plumbing.

PART 2 – PRODUCTS

2.01 FLOOR DRAINS

A. Manufacturer: Josam, Smith, Wade, Watts, Zurn
B. Refer to drain schedules on plumbing plans for additional information.

2.02 HUB DRAINS

A. Refer to drain schedules on plumbing plans for additional information.

2.03 ROOF DRAINS

A. Manufacturer: Josam, Smith, Wade, Watts, Zurn
B. Refer to drain schedules on plumbing plans for additional information for roof drains, overflow drains and downspout nozzles.

2.04 CLEANOUTS

A. Manufacturer: Josam, Smith, Wade, Watts, Zurn

B. Interior Concrete Floor Areas: Enameled cast iron body with round or square adjustable scoriated polished nickel bronze cover, tapered threaded ABS closure plug. Zurn ZN-1400-/ ZN-1400-T.

C. Interior Ceramic Tile Floor Areas: Enameled cast iron body with square adjustable scoriated nickel bronze cover, tapered threaded ABS closure plug. Zurn ZN-1400-T.

D. Interior Vinyl Tile Floor Areas: Enameled cast iron body with round adjustable scoriated nickel bronze cover, tapered threaded ABS closure plug. Zurn ZN-1400.

E. Interior Carpeted Floor Areas: Enameled cast iron body with round adjustable scoriated nickel bronze cover and secured carpet marker, tapered threaded ABS closure plug. Zurn Z-1400-CM.

F. Interior Finished Wall Areas: Line type cleanout tee with tapered threaded ABS cleanout plug, round polished stainless steel access cover secured with machine screw. Screw shall not pass completely through ABS plug, trim screw as necessary. Zurn Z-1446.

G. Interior Exposed Vertical Stacks: Line type cleanout tee with tapered threaded ABS closure plug. Zurn Z-1445.

H. Interior Horizontal Lines: Cast iron hub with tapped ferrule and tapered threaded ABS or PVC closure plug, or no-hub coupling and blind plug.

I. Exterior (Yard): Schedule 40 PVC frost sleeve and access cover, sized to fit over a 6” diameter cleanout riser, 48” long. Stamp access cover with “SAN” or “ST” legend. Plumbing Creations PVC-48-8.

2.05 BACKWATER VALVES

A. Manufacturers: Josam, J.R. Smith, Watts, Zurn

B. Hub and spigot or No-Hub inlet and outlet cast iron body, cast iron gasketed bolted access cover, bronze valve. Flapper to hang in closed position during non-operation period. Zurn Z1090.

2.06 WATER HAMMER ARRESTORS

A. Manufacturer: PPP Industries, Sioux Chief, Wade, Watts

B. ANSI A112.26.1M, ASSE 1010; sized in accordance with PDI WH-201, precharged piston type constructed of hard drawn copper, threaded brass adapter, brass piston with o-ring seals, FDA approved lubricant, suitable for operation in temperature range 35 to 180 degrees F, maximum 150 psig working pressure. Watts LF15.

2.07 BACKFLOW PREVENTERS

A. Manufacturers: Cash-Acme, Cla-Val, Conbraco, Febco, Watts, Wilkins

B. Hose Connection Vacuum Breakers: ASSE 1011, brass or bronze construction, EPDM diaphragm and seat, rated for 125 psig and 180°F. Watts 8 (interior application).

C. Pipe Applied Atmospheric Type Vacuum Breakers: ASSE 1001, same size as pipe, brass or bronze construction, silicone disc, rated for 125 psig and 160°F. Watts 288A.

D. Dual Check with Atmospheric Vent for carbon dioxide post mix vending machines: ASSE 1022, 3/8”, stainless steel body and parts, dual check with third ball check outlet, rated for 150 psig and 140°F. Watts SD-3.

E. Anti-Siphon Pressure Type Vacuum Breakers: ASSE 1020, same size as pipe, brass or bronze construction, silicone disc, plastic seat, stainless steel spring, inlet and outlet ball shutoff valves, test port ball valves, rated for 150 psig and 110°F. Watts 800M4QT.

F. Intermediate Atmospheric Vented Backflow Preventers: ASSE 1012, same size as pipe, with intermediate atmospheric vent between independent check valves, bronze body with union ends, stainless steel springs, rated for 175 psig and 210° F. Watts 9DM.

G. Reduced Pressure Zone Backflow Preventers (RPBP): ASSE 1013 reduced pressure zone backflow assembly complete with inlet strainer, inlet and outlet ball or non-rising stem gate isolation valves. Size per Drawings. Constructed of lead free bronze or epoxy coated cast iron body with bronze and plastic internal parts, stainless steel springs, non-threaded vent outlet, 4 test cocks, rated for 175 psig and 180° F intermittent, with fixed air gap apparatus on drain.

1. 3 inches and smaller: Watts series LF009-S-QT(NRS)-AG.
2. 3 inches and larger: Watts series 957.

2.08 WALL HYDRANTS

A. Manufacturer: Chicago Faucet, Josam, J.R. Smith, Mifab, Wade, Watts, Woodford, Zurn

B. WH-1: Freeze proof automatic draining wall hydrant, with chrome plated wall box and door, 3/4” inlet, 3/4” hose thread ASSE 1019-B hose connection vacuum breaker, and loose key operator. Woodford Model B65CH.

2.09 HOSE BIBBS

A. Manufacturer: Chicago Faucet, Josam, J.R. Smith, Mifab, Wade, Watts, Woodford, Zurn

B. HB-1: Bronze or brass body hose faucet, 3/4" inlet, 3/4” outlet, with polished chrome finish, ASSE 1011 hose connection vacuum breaker and metal wheel handle. Woodford Model 24PC.

C. RH-1: ASSE 1057 listed, roof hose faucet, 3/4" inlet, 3/4” outlet, with ASSE 1052 dual check backflow preventer and exterior drain. Interior drain piping not required. Woodford Model SRH-MS.

2.10 TRAP GUARDS

A. Manufacturers: ProSet Systems Trap Guard, Rectorseal SureSeal, PPP Pro-Drain, Mifab

B. Flexible elastomeric PVC construction diaphragm trap guard for installation in new and existing floor drains, hub drains, and trench drains, ASSE 1072. Trap guard to prevent trap evaporation and waste backflow. Size as applicable to the drain outlet size.

2.11 SAFINGS

A. Manufacturers: Noble, DalSeal, Oatey

B. Chlorinated polyethylene sheeting, 40 mils thick, ASTM D4068, joined with CPE solvent.

C. 3 lb. / square foot sheet lead.

2.12 VENT FLASHINGS

A. Manufacturers: Semco, Oatey

B. Formed 3 lb. /sq. ft. lead flashing with minimum base size of 15"x17".

C. Single Ply Membrane Roofs: Flashing boot of material compatible with roofing membrane with base flange for adhering to membrane and two stainless steel adjustable drawbands for securing to vent pipe.

2.13 WALL BOXES

A. Manufacturer: Guy Gray, Oatey, Sioux Chief

B. WB-1: Fire rated steel washing machine wall box, recessed, white powder coated finish, with faceplate frame, intumescent pad, top tapping for 1/2” sweat or threaded cold and hot water inlets, NSF 61 quarter turn ball valves, water hammer arrestors, and bottom tapping for 2” drain. Non-rated wall box acceptable for use in non-rated walls. Guy Gray Model FRM12SHA.

C. WB-2: Fire rated steel ice maker wall box, recessed, white powder coated finish, with faceplate frame, intumescent pad, 1/2” sweat or threaded inlet, NSF 61 quarter turn ball

valve, water hammer arrestor. Non-rated wall box acceptable for use in non-rated walls. Guy Gray Model FRMIB12S.

2.14 SOLIDS INTERCEPTORS

A. Manufacturers: Striem, Josam, J.R. Smith, Rockford, Wade, Watts, Zurn.
B. Refer to equipment schedules on plumbing drawings for additional information.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Coordinate location and setting of plumbing specialties with adjacent construction. Install in accordance with manufacturers recommendations.

B. Set floor drains level and plumb adjusted to finished floor elevation. Locate where serviceable.

C. Set roof drains level and plumb adjusted to finished roof elevation. Locate where serviceable.

D. Set cleanouts level and plumb adjusted to finished floor elevation or finished wall location. Locate where serviceable. Allow minimum of 18" clearance around cleanouts for rodding. Lubricate threaded cleanout plugs with graphite and oil, Teflon tape or waterproof grease.

E. Install trap guards and/or trap primer connections where indicated.

F. Provide deep seal traps on floor drains and hub drains installed in mechanical rooms, penthouses, or rooms with excessive positive or negative pressure.

G. Floor drains and hub drains installed in public restrooms, locker rooms, seldom used rooms, and areas with minute drainage flow shall have installations of trap guards or trap primers.

H. Set backwater valves on undisturbed soil or compacted granular backfill, level and plumb with top adjusted to finished floor elevation. Test and adjust valve for proper operation. Allow minimum 18" clearance for servicing.

I. Install water hammer arrestors where indicated and at quick closing valve installations.

J. Install backflow preventers in accordance with Wisconsin Department of Safety & Professional Services requirements maintaining minimum clearance distances for servicing and testing. Provide indirect waste piping with air gap installation from relief opening to above hub drain or floor drain.

K. Where backflow preventers requiring Department of Safety & Professional Services registration are installed, obtain Regulated Object ID Number from the plumbing approval letter, and provide initial testing and report filing as required. If Regulated Object ID Number is not listed on the plumbing approval letter, obtain Regulated Object ID Number from DSPS, and provide initial testing and report filing required by Department of Safety & Professional Services.

L. Mount wall hydrants in exterior wall construction with valve extended beyond interior side of building insulation. Slope to drain to building exterior. Install top of recessed wall box at 24” minimum above finished grade at building exterior. Refer to Architectural building elevations for additional information. Set wall hydrant in grout or caulk and fill exterior wall penetration with insulation.

M. Install safing at floor drains above grade. Extend 12" beyond drains in all directions. Cover entire floor in showers and extend 6" up in walls above curbs and to a height of 6' (3" wide each direction) in corners. Install on concrete floor that is smooth and free of debris. Seal all joints and connect to drain body clamp. Safing is subject to standing water leak test. Install safing at all built-up shower installations. Spray-on and brush-applied liquid safing is not acceptable.

N. Flash vent penetrations through roof. Turn down top of lead flashing into vent pipe. Tighten drawband of membrane boot to vent pipe. Adhere base flashing to deck or membrane. Provide waterproof patch around penetration on existing roofs.

O. Install wall box water outlets for residential type refrigerator water connections at 60” above finished floor, unless noted otherwise.

P. Install interceptors as close to fixture(s) as possible, maintaining clearance above the interceptor for cleaning and maintenance. Set recessed interceptors on compacted granular backfill adjusting for plumb and level. Adjust cover to finished floor elevation. Do not support interceptor from piping.

Q. Solids Interceptor: Install where shown on plan. Provide required clearance for basket strainer removal.

END OF SECTION

SECTION 22 05 15
PIPING SPECIALTIES

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Base Bid: Unless noted otherwise, the Plumbing Contractor shall provide all labor and materials for a complete system in this specification section.

1.02 SECTION INCLUDES

A. This section contains specifications for plumbing piping specialties for all piping systems.
   1. Thermometers
   2. Thermometer Sockets
   3. Test Wells
   4. Test Plugs
   5. Pressure Gauges
   6. Strainers
   7. Water Flow Meters

1.03 RELATED WORK

A. Applicable provisions of Division 1 govern work under this section.
B. Section 22 05 23 – General-Duty Valves for Plumbing Piping
C. Section 22 07 00 – Plumbing Insulation
D. Section 22 11 00 – Facility Water Distribution
E. Section 22 30 00 – Plumbing Equipment

1.04 SUBMITTALS

A. Refer to Section 22 05 00 – Common Work Results for Plumbing, Submittals. In addition to the general content specified under Section 22 05 00 – Common Work Results for Plumbing, supply the following submittals:
   1. Thermometers
   2. Thermometer Sockets
   3. Test Wells
   4. Test Plugs
   5. Pressure Gauges
   6. Strainers
   7. Water Flow Meters
B. Include materials of construction, dimensional data, ratings/capacities/ranges, approvals, test data, pressure drop data where appropriate, and identification as referenced in this section and/or on the drawings.

1.05 REFERENCE STANDARDS

A. ASTM B650 Electrodeposited Engineering Chromium Coatings on Ferrous Substrates

1.06 QUALITY ASSURANCE

A. Substitution of Materials: Division 1.

1.07 DESIGN CRITERIA

A. All piping specialties are to be rated for the highest pressures and temperatures in the respective system in accordance with ANSI B31, but not less than 125 psig unless specifically indicated otherwise.

1.08 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified in Section 22 05 00 – Common Work Results for Plumbing.

PART 2 – PRODUCTS

2.01 THERMOMETERS

A. Ashcroft, Marsh, Taylor, H. O. Trerice, Ametek/U. S. Gauge, Weiss, Wika, Weksler

B. Stem Type: Cast aluminum case, nine inch scale, clear acrylic window. adjustable angle brass stem with stem of sufficient length so the end of the stem is near the middle of a pipe without reducing the thickness of any insulation, red indicating fluid, black lettering against a white background, with scale ranges as follows:

Service	Hot Water
Scale Range, °F	30 - 180
Increment, °F	2

2.02 THERMOMETER SOCKETS

A. Brass with threaded connections suitable for thermometer stems and temperature control sensing elements in pipeline. Furnish with extension necks for insulated piping systems.

2.03 TEST WELLS

A. Similar to thermometer sockets except with a brass cap that threads into the inside of the test well to prevent dirt from accumulating. Secure cap to body with a short chain. Furnish with extension necks, where appropriate, to accommodate the pipeline insulation.

2.04 TEST PLUGS

A. Brass threaded pressure and temperature test plug with neoprene self-closing valve, valve retainer, brass threaded cap, rated for 150 psi and 0-200 degrees F.

2.05 PRESSURE GAUGES

A. Ametek/U. S. Gauge, Ashcroft, Marsh, Taylor, H. O. Trerice, Weiss, Wika, Weksler

B. Cast aluminum case of not less than 4.5 inches in diameter, double strength glass window, black lettering on a white background, phosphor bronze bourdon tube with bronze bushings, recalibration from the front of the dial, 99% accuracy over the middle half of the scale, 98.5% accuracy over the remainder of the scale, with scale range as follows:

Service	Hot Water	Cold Water	Compressed Air
Scale Range, psig	0-100	0-100	0-200
Increment, psig	1	1	2

C. Pressure Snubbers: Bronze construction, 300 psig working pressure, 1/4" size.

D. Gauge Valves: Use ball valves as specified in Section 22 05 23 - General-Duty Valves for Plumbing Piping.

2.06 STRAINERS

A. Armstrong, Illinois, Keckley, Metraflex, Mueller Steam, Sarco, Watts.

B. 4” and smaller: Wye pattern lead free; cast bronze body, 20 mesh stainless steel screen; threaded screen retainer tapped for closure plug; sweat or threaded, rated at 300 psi at 210 deg F. Include drain valve for blowdown. Watts LF777S, LFS777S.

C. 4” and larger: Y type; cast iron body, ASTM A126; 20 mesh stainless steel screens; bolted or threaded screen retainer tapped for a blowoff valve; threaded or flanged ends; rated at not less than 150 psi WOG. Include drain valve for blowdown.

2.07 WATER FLOW METERS

A. Manufacturers: Hedland, Omega, Onicon, Badger Meter.

B. WFM-1 Insertion turbine flow sensor and display water flow meter, for potable water use NSF/ANSI 61 compliant, electronic impedance sensing, with display unit by same manufacturer mounted for easy visibility. Unit to include scaled pulse frequency output with signal to BAS, recording instantaneous gpm and total gallons over selectable time ranges. 2-percent accuracy from 0.4 to 20 ft/sec water velocity, frequency output 0-15 V, 3-wire electrical connections, 24 V, field tested and calibrated. Onicon F-1100.

C. WFM-2 Direct reading water flow meter for potable water use, plastic body with polysulfone piston and cone, stainless steel spring, Buna N flow indicator ring and pressure seals, polypropylene or polycarbonate limit indicators, NPT or sweat brass fittings, 5-percent accuracy over full scale and rated for 325 psi and 250 deg F maximum temperature. Able to be installed in any position, with no electrical connections. For use up to 100 gpm peak flow, with model chosen based on peak expected flow. Hedland EZ-View H615 or H617.

PART 3 – EXECUTION

3.01 THERMOMETERS

A. Stem Type: Install in piping systems as indicated on the drawings and/or details using a separable socket in each location.

3.02 THERMOMETER SOCKETS

A. Install at each point where a thermometer or temperature control sensing element is located in a pipeline.

3.03 TEST WELLS

A. Install in piping systems as indicated on the drawings and/or details wherever provisions are needed for inserting a thermometer at a later date.

3.04 TEST PLUGS

A. Install in piping systems as indicated on the drawings and/or details wherever provisions are needed for short-term measurement of pressure or temperature.

3.05 PRESSURE GAUGES

A. Install in locations where indicated on the drawings and/or details, with scale range appropriate to the system operating pressures.

B. Pressure Snubbers: Install in gauge piping for all gauges used on water services.

C. Gauge Valves: Install at each gauge location as close to the main as possible and at each location where a gauge tapping is indicated.

3.06 STRAINERS

A. Install all strainers where indicated allowing sufficient space for the screens to be removed. Install a drain valve for blowout in the tapped screen retainer.

3.07 WATER FLOW METERS

A. Install where indicated on the drawings. Install in accordance with manufacturer’s recommendations. Inlet and outlet piping must be properly aligned to minimize structural stress on the meter body.

B. Install meter body so scale can be conveniently read from floor.

END OF SECTION

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SECTION 22 05 23
GENERAL DUTY VALVES FOR PLUMBING PIPING

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Base Bid: Unless noted otherwise, the Plumbing Contractor shall provide all labor and materials for a complete system in this specification section.

1.02 SECTION INCLUDES

A. This section includes valve specifications for all Plumbing systems except where indicated under Related Work.
   1. Water System Valves
      a. Ball Valves
      b. Butterfly Valves
      c. Swing Check Valves
      d. Balancing Valves
      e. Drain Valves
      f. Spring Loaded Check Valves
   2. Waste System Valves
      a. Gate Valves (Waste)
      b. Ball Valves (Waste)
      c. Swing Check Valves (Waste)
   3. Specialty Valves And Valve Accessories
      a. Gauge Valves
      b. Safety Relief Valves

1.03 RELATED WORK

A. Applicable provisions of Division 1 govern work under this section.
B. Section 22 05 14 – Plumbing Specialties
C. Section 22 11 00 – Facility Water Distribution
D. Section 22 13 00 – Facility Sanitary Sewerage
E. Section 22 14 00 – Facility Storm Drainage
F. Section 22 30 00 – Plumbing Equipment

1.04 SUBMITTALS

A. Refer to Section 22 05 00 – Common Work Results for Plumbing, Submittals. In addition to the general content specified under Section 22 05 00 – Common Work Results for Plumbing, supply the following submittals:
   1. Water System Valves
      a. Ball Valves
      b. Butterfly Valves
      c. Swing Check Valves
      d. Balancing Valves
      e. Drain Valves
      f. Spring Loaded Check Valves
   2. Waste System Valves

a. Gate Valves (Waste)
b. Ball Valves (Waste)
c. Swing Check Valves (Waste)

3. Specialty Valves And Valve Accessories
   a. Gauge Valves
   b. Safety Relief Valves

B. Schedule of all valves indicating type of service, dimensions, materials of construction, and pressure/temperature ratings for all valves to be used on the project. Temperature ratings specified are for continuous operation.

1.05 QUALITY ASSURANCE

A. Substitution of Materials: Refer to Division 1.

1.06 DESIGN CRITERIA

A. ANSI Z21.22 - Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems.

B. Where valve types (ball, butterfly, etc.) are specified for individual plumbing services (i.e. domestic water, gas, etc.), each valve type shall be of the same manufacturer unless prior written approval is obtained from the Owner.

C. Valves to be line size unless specifically noted otherwise.

D. Valves installed in potable water lines to be NSF/ANSI 61 lead free compliant.

1.07 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified in Section 22 05 00 – Common Work Results for Plumbing.

PART 2 - PRODUCTS

2.01 WATER SYSTEM VALVES

A. Manufacturers: Apollo, Asco, Conbraco, Crane, Hammond, Jomar, Milwaukee Valve, Nibco, Stockham, Watts

B. All water system valves to be rated at not less than 125 water working pressure at 240 degrees F unless noted otherwise.

C. Ball Valves:

1. 3” and smaller: Two piece bronze body; full port, sweat or threaded ends, chrome plated bronze ball; glass filled teflon seat; teflon packing and threaded packing nut; blowout-proof stem; 600 psig WOG. Provide valve stem extensions for valves installed in all piping with insulation. Apollo 77CLF-A, Milwaukee UPBA400/450, Nibco TS-585-80-LF, Watts LFB-6080/6081-G2.
   a. Press Fit: Only where specifically permitted elsewhere in these specifications, product is to meet above requirements. Nibco PC-585-80-LF.

D. Butterfly Valves:

1. 2-1/2” and larger: Cast or ductile iron body; stainless steel shaft; bronze, copper or Teflon bushings; EPDM resilient seat; EPDM seals; bronze, aluminum-bronze, EPDM encapsulated ductile iron or stainless steel disc. 200 psig WOG through 12”, 150 psig WOG through 24”. Valve assembly to be bubble tight to 175 psig with no downstream flange/pipe attached. Use tapped lug type valves with stud bolts or cap screws, or grooved end connection valves, permitting removal of downstream piping while using the valve for system shutoff. Provide 10 position locking lever handle actuators for valves 6” and smaller. Provide worm gear operators with external position indication for valves 8” and larger. Hammond 5200 or 6200 series, Milwaukee M or C series, Nibco LD2000/LC2860, Victaulic 608, Watts BF-03-M2.

E. Swing Check Valves:

1. 3" and smaller: Bronze body, sweat or threaded ends, Y-pattern, renewable PTFE seat and disc, Class 125, suitable for installation in a horizontal or vertical line with flow upward. Nibco TS-413-Y-LF
2. 4" and larger: Cast iron body, flanged ends, bronze trim, bolted cap, renewable bronze seat and disc, Class 125, non-asbestos gasket, suitable for installation in a horizontal or vertical line with flow upward. Nibco F918B

F. Balancing Valves:

1. 2" and smaller: Two piece bronze body ball valve, sweat or threaded ends, chrome plated brass ball, glass filled Teflon seat, threaded packing nut, with adjustable memory stop position indicator and extended handle stem, suitable for 400 psig water working pressure at 240 deg F. Nibco TS-580-80-LF, Hammond UP8501-02 or UP8511-02, Milwaukee UPBA-100MS or UPBA-150MS or equal by Apollo, Watts.
2. 2” and smaller: Lead free brass body with sweat or threaded ends, type 304 stainless steel ball, glass filled TFE seat, two capped pressure differential read-out ports, tapped and plugged drain port, with adjustable memory stop position indicator, rated for 200 psig at 250 deg F. Deliver two manufacturer provided circular plastic valve calculator charts. Bell & Gossett Circuit Setter Plus, CB or RF Series.
3. 2” and smaller: Thermostatic, automatically and continuously adjusts flow to maintain desired temperature, lead free 303 stainless steel body and actuator with threaded ends, EPDM rubber O-ring, 200 psig at 250 deg F. Manual balancing of valve not required. Valve does not close completely, with minimum listed Cv 0.1 at closed position. ThermOmegaTech Circuit Solver, CS Series.

G. Drain Valves:

1. 3/4" ball valve with integral threaded hose adapter, sweat or threaded inlet connections, with threaded cap and chain on hose threads. Apollo 70LF-200-HC, Milwaukee UPBA-100H or UPBA-150H, Hammond UP8501H or UP8511H, or equal by Nibco or Watts

H. Spring Loaded Check Valves:

1. 2" and smaller: Bronze body, sweat or threaded ends, bronze trim, stainless steel spring, stainless steel center guide pin, Class 125, PTFE seat unless only bronze available. Apollo 61LF, Nibco TS-480-Y-LF, Watts LF600, Zurn 40XL2
2. 2-1/2" and larger: Cast or ductile iron body, wafer or globe type, bronze trim, bronze or EPDM seat, stainless steel spring, stainless steel stem if stem is required, Class 125. Nibco W910 or F910
3. 3/8” compression: Downstream of fixture stop valve, compression x compression, NSF/ANSI 372 low lead: Chicago 243.315.AB.1

2.02 WASTE SYSTEM VALVES

A. Gate Valves: 2" and smaller: Bronze body, bronze trim, threaded ends, solid wedge, rising stem, union bonnet, malleable iron hand wheel, suitable for 300 psi WOG. Nibco T134

B. Ball Valves: 3" and smaller: Two piece bronze body; sweat or threaded ends, chrome plated bronze ball; glass filled Teflon seat; Teflon packing and threaded packing nut; blowout-proof stem; 400 psig WOG. Nibco TS-585-70

C. Swing Check Valves:

1. 1-1/2" and smaller: Bronze body, sweat or threaded ends, Y-pattern, regrindable bronze seat, renewable bronze disc, Class 125, suitable for installation in a horizontal or vertical line with flow upward. Nibco TS-413B
2. 2" and larger: Cast iron body, flanged ends, bronze trim, bolted cap, renewable bronze seat and disc, Class 125, non-asbestos gasket, outside lever and weight or spring, suitable for installation in a horizontal or vertical line with flow upward. Nibco F918B

2.03 SPECIALTY VALVES AND VALVE ACCESSORIES

A. Gauge Valves: Use 1/4" ball valves. Needle valves and gauge cocks will not be accepted.

B. Safety Relief Valves:

1. Manufacturers: Bell & Gossett, Apollo/Conbraco, Watts, Zurn/Wilkins
2. Bronze body, temperature and pressure actuated stainless steel stem and spring, thermostat with non-metallic coating, test lever, suitable for 125 psig water working pressure at 240 degrees F, sized for full BTUH input and operating pressure of equipment, with valve capacity on metal label. For equipment less than or equal to 200,000 BTUH input, provide AGA, UL or ASME listed and labeled valve. Provide ASME listed and labeled valve for larger equipment. Temperature and pressure relief valve shall be sized using the AGA steam temperature rating per SPS 382.40(5)(d).

PART 3 – EXECUTION

3.01 GENERAL

A. Properly align piping before installation of valves. Install and test valves in strict accordance with valve manufacturer's installation recommendations. Do not support weight of piping system on valve ends.

B. Mount valves in locations which allow access for operation, servicing and replacement.

C. Provide valve handle extensions for all valves installed in insulated piping.

D. Install all valves with the stem in the upright or horizontal position. If possible, install butterfly valves with the stem in the horizontal position. Valves installed with the stems down will not be accepted.

E. Prior to flushing of piping systems, place all valves in the full-open position.

3.02 SHUT OFF VALVES

A. Install shut-off valves at each piece of equipment, at each branch take-off from mains for isolation or repair and elsewhere as indicated.

3.03 BALANCING VALVES

A. Install where indicated on the drawings and details for balancing of flow in pumped hot water recirculation piping systems.

B. Upon project completion, adjust each valve and set position stop. Balance system to minimum flow in return piping branches needed to maintain even supply water temperature throughout building.

3.04 DRAIN VALVES

A. Provide drain valves for complete drainage of all systems. Locations of drain valves include low points of piping systems, downstream of riser isolation valves, equipment locations specified, or detailed, other locations required for drainage of systems and elsewhere as indicated.

3.05 SPRING LOADED CHECK VALVES

A. Install a spring loaded check valve in each circulating pump discharge line, each clearwater sump pump discharge line and elsewhere as indicated.

3.06 SWING CHECK VALVES

A. Install swing check valves in recirculation branch lines and elsewhere as indicated. Provide weighted swing check valves at sanitary sump pump discharges.

3.07 SAFETY RELIEF VALVES

A. Install relief valves on all pressure vessels and elsewhere as indicated. Inlet and outlet piping connecting to valves must be the same size as valve connections or larger. Pipe discharge to drain where indicated or to floor.

END OF SECTION

SECTION 22 05 29

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Base Bid: Unless noted otherwise, the Plumbing Contractor shall provide all labor and materials for a complete system in this specification section.

1.02 SECTION INCLUDES

A. This section includes specifications for supports of all plumbing equipment and materials as well as piping system anchors.

1. Structural Supports
2. Pipe Hangers And Supports
3. Pipe Hanger Rods
4. Beam Clamps
5. Concrete Inserts
6. Continuous Concrete Insert Channels
7. Anchors
8. Equipment Stands
9. Corrosive Atmosphere Coatings

1.03 RELATED WORK

A. Applicable provisions of Division 1 shall govern work under this section.

B. Section 03 10 00 – Concrete Formwork for equipment pads

C. Section 03 30 00 – Cast-in-Place Concrete for equipment pads

D. Section 22 07 00 – Plumbing Insulation for insulation protection at support devices

1.04 SUBMITTALS

A. Refer to Section 22 05 00 – Common Work Results for Plumbing. In addition to the general content specified under Section 22 05 00 – Common Work Results for Plumbing, supply the following submittals:

1. Structural Supports
2. Pipe Hangers And Supports
3. Pipe Hanger Rods
4. Beam Clamps
5. Concrete Inserts
6. Continuous Concrete Insert Channels
7. Anchors
8. Equipment Stands
9. Corrosive Atmosphere Coatings

B. Schedule of all hanger and support devices indicating attachment methods and type of device for each pipe size and type of service.

C. All submittals are to comply with submission and content requirements specified within Section 22 05 00 – Common Work Results for Plumbing.

1.05 REFERENCE STANDARDS

A. MSS SP-58 Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, And Installation.

1.06 QUALITY ASSURANCE

A. Substitution of Materials: Refer to Division 1.

1.07 DESCRIPTION

A. Provide all supporting devices as required for the installation of plumbing equipment and materials. All supports and installation procedures are to conform to the latest requirements of the ANSI Code for building piping.

B. Do not hang any plumbing item directly from a metal deck or run piping so its rests on the bottom chord of any truss or joist.

C. Fasteners depending on soft lead for holding power or requiring powder actuation will not be accepted.

D. Support apparatus and material under all conditions of operation, variations in installed and operating weight of equipment and piping, to prevent excess stress, and allow for proper expansion and contraction.

E. Protect insulation at all hanger points; see Related Work above.

1.08 DESIGN CRITERIA

A. Materials and application of pipe hangers and supports shall be in accordance with MSS Standard Practice SP-58 unless noted otherwise.

B. Piping connected to pumps, compressors, or other rotating or reciprocating equipment is to have vibration isolation supports for a distance of one hundred pipe diameters or three supports away from the equipment, whichever is greater. Standard pipe hangers/supports as specified in this section are required beyond the 100 pipe diameter/3 support distance.

PART 2 – PRODUCTS

2.01 STRUCTURAL SUPPORTS

A. Provide all supporting steel required for the installation of plumbing equipment and materials, including angles, channels, beams, etc. to suspended or floor supported tanks and equipment. All of this steel may not be specifically indicated on the drawings.

2.02 PIPE HANGERS AND SUPPORTS

A. Manufacturers: Anvil, B-Line, Grinnell, Pate, Piping Technology, Roof Products & Systems.

B. Hangers for Pipe Sizes 1/2" through 2":

1. Carbon steel, adjustable swivel ring.
2. Carbon steel, adjustable clevis, standard.

C. Hangers for Pipe Sizes 2" and Larger:

1. Carbon steel, adjustable clevis, standard.

D. Multiple or Trapeze Hangers:

1. Steel channels with welded spacers and hanger rods.

E. Wall Support:

1. Carbon steel welded bracket with hanger.
2. Perforated, epoxy painted finish, 16-12 gauge, min., steel channels securely anchored to wall structure, with interlocking, split-type, bolt secured, galvanized pipe/tubing clamps. When copper piping is being supported, provide flexible elastomeric/thermoplastic isolation cushion material to completely encircle the piping and avoid contact with the channel or clamp.

F. Vertical Support:
   1. Carbon steel riser clamp for above floor use.
G. Floor Support:
   1. Carbon steel pipe saddle, stand and bolted floor flange.
H. Copper Pipe Supports:
   1. All supports, fasteners, clamps, etc. directly connected to copper piping shall be copper plated or polyvinylchloride coated. Where steel channels are used, provide isolation collar between supports/clamps/fasteners and copper piping.

2.03 PIPE HANGER RODS

A. Steel Hanger Rods:
   1. Threaded both ends, threaded one end, or continuous threaded, complete with adjusting and lock nuts.
   2. Size rods for individual hangers and trapeze support as indicated in the following schedule.
   3. Total weight of equipment, including valves, fittings, pipe, pipe content, and insulation, are not to exceed the limits indicated.

Maximum Load (Lbs.) (650°F Maximum Temp.)	Rod Diameter (inches)
610	3/8
1130	1/2
1810	5/8
2710	3/4
3770	7/8
4960	1
8000	1-1/4

2.04 BEAM CLAMPS

A. MSS SP-58 Types 19 & 23 malleable black iron clamp for attachment to beam flange to 0.62 inches thick with a retaining ring and threaded rod of 3/8, 1/2, and 5/8 inch diameter. Furnish with a hardened steel cup point set screw.
B. MSS SP-58 Type 28 or Type 29 forged steel jaw type clamp with a tie rod to lock clamp in place, suitable for rod sizes to 1-1/2 inch diameter.

2.05 CONCRETE INSERTS

A. Poured in Place:
   1. MSS SP-58 Type 18 wedge type to be constructed of a black carbon steel body with a removable malleable iron nut that accepts threaded rod to 7/8 inch diameter. Wedge design to allow the insert to be held by concrete in compression to maximize the load carrying capacity.
   2. MSS SP-58 Type 18 universal type to be constructed of black malleable iron body with a removable malleable iron nut that accepts threaded rod to 7/8 inch diameter.
B. Drilled Fasteners:
   1. Carbon steel expansion anchors, vibration resistant, with ASTM B633 zinc plating. Use drill bit of same manufacturer as anchor. Hilti, Rawl, Redhead.

2.06 CONTINUOUS CONCRETE INSERT CHANNELS

A. Steel inserts with an industry standard pre-galvanized finish, nominally 1-5/8 inch wide by 1-3/8 inch deep by length to suit the application, designed to be nailed to concrete forms and provide a linear slot for attaching other support devices. Installed channels to provide a load rating of 2000 pounds per foot in concrete. Manufacturer's standard brackets, inserts, and

accessories designed to be used with the channel inserts may be used. Select insert length to accommodate all pipe in the area.

2.07 ANCHORS

A. Use welding steel shapes, plates, and bars to secure piping to the structure.

2.08 EQUIPMENT STANDS

A. Use structural steel members welded to and supported by pipe supports. Clean, prime and coat with three coat rust inhibiting alkyd paint or one coat epoxy mastic. Where exposed to weather, treat with corrosive atmosphere coatings.

2.09 CORROSIVE ATMOSPHERE COATINGS

A. Factory coat supports and anchors used in corrosive atmospheres with hot dip galvanizing after fabrication, ASTM A123, 1.5 ounces/square foot of surface each side. Mechanical galvanize threaded products, ASTM B695 Class 50, 2.0 mil coating. Field cuts and damaged finishes to be field covered with zinc rich paint of comparable thickness to factory coating.

B. Corrosive atmospheres include the following locations:

1. Exterior locations
2. Wet wells
3. Sanitary pumping stations
4. Food service/kitchen areas

PART 3 – EXECUTION

3.01 INSTALLATION

A. Size, apply and install supports and anchors in compliance with manufacturers recommendations.

B. Install supports to provide for free expansion of the piping system. Support all piping from the structure using concrete inserts, beam clamps, ceiling plates, wall brackets, or floor stands. Fasten ceiling plates and wall brackets securely to the structure and test to demonstrate the adequacy of the fastening.

C. Coordinate hanger and support installation to properly group piping of all trades.

D. Where piping can be conveniently grouped to allow the use of trapeze type supports, use standard structural shapes or continuous insert channels for the supporting steel. Where continuous insert channels are used, pipe supporting devices made specifically for use with the channels may be substituted for the specified supporting devices provided that similar types are used and all data is submitted for prior approval.

E. Size and install hangers and supports, except for riser clamps, for installation on the exterior of piping insulation. Where a vapor barrier is not required, hangers may be installed either on the exterior of pipe insulation or directly on piping.

F. Perform welding in accordance with standards of the American Welding Society.

3.02 HANGER AND SUPPORT SPACING

A. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.

B. Place a hanger within 12 inches of each horizontal elbow, valve, strainer, or similar piping specialty item.

C. Use hangers with 1-1/2 inch minimum vertical adjustment.

D. Support riser piping independently of connected horizontal piping.

E. Greater hanger support distances may be used for CPVC and PEXa piping systems where metallic carrier channels are used in conformance with the manufacturer's recommendations and meet all code requirements.

F. Adjust hangers to obtain the slope specified in the piping section of these specifications.

G. Space hangers for pipe as follows:

Pipe Material	Pipe Size	Max. Horiz. Spacing	Max. Vert. Spacing
Cast Iron	2" and larger	5'-0"	15'-0"
Copper	½” through ¾”	5'-0"	10'-0"
Copper	1" through 1¼”	6'-0"	10'-0"
Copper	1½” through 2½”	8'-0"	10'-0"
Copper	3"	10'-0"	10'-0"
Copper	4" and larger	12'-0"	10'-0"
Ductile Iron	All	10'-0"	20'-0"
Steel	½” through 1¼”	7'-0"	15'-0"
Steel	1½” through 6"	10'-0"	15'-0"
Steel	8" through 12"	14'-0"	20'-0"
Plastic (DWV)	1½” and larger	4'-0"	10'-0"
Plastic	1" and smaller	32”	4'-0"
Plastic	1¼” and over	4'-0"	6'-0"
Stainless Steel	1” – 2”	10’-0”	10’-0”
Stainless Steel	2 ½” and larger	10’-0”	10’-0”

3.03 RISER CLAMPS

A. Support vertical piping with clamps secured to the piping and resting on the building structure or secured to the building structure below at each floor.

3.04 CONCRETE INSERTS AND CONTINUOUS INSERT CHANNELS

A. Select size based on the manufacturer's stated load capacity and weight of material that will be supported. Locate continuous insert channels on 6'-0" maximum centers and 2'-0" from corners. Furnish inserts to the General Contractor for placement in concrete formwork. Use inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inch size. Where concrete slabs form finished ceiling, provide inserts that are flush with the slab surface.

3.05 ANCHORS

A. Install where indicated on the drawings and details. Where not specifically indicated, install anchors at ends of principal pipe runs and at intermediate points in pipe runs between expansion loops. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

END OF SECTION

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SECTION 22 07 00
PLUMBING INSULATION

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Base Bid: Unless noted otherwise, the Plumbing Contractor shall provide all labor and materials for a complete system in this specification section.

1.02 SECTION INCLUDES

A. This section includes insulation specifications for plumbing piping and equipment.
   1. Insulation:
      a. Rigid Fiberglass Insulation
      b. Semi-Rigid Fiberglass Insulation
      c. Elastomeric Insulation
      d. Fireproofing Insulation
   2. Covers and Jackets
   3. Insulation Inserts And Pipe Shields
   4. Accessories

1.03 RELATED WORK

A. Applicable provisions of Division 1 govern work under this section.
B. Section 22 05 00 – Common Work Results for Plumbing
C. Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment
D. Section 22 11 00 – Facility Water Distribution
E. Section 22 13 00 – Facility Sanitary Sewerage
F. Section 22 14 00 – Facility Storm Drainage
G. Section 22 30 00 – Plumbing Equipment

1.04 SUBMITTALS

A. Refer to Section 22 05 00 – Common Work Results for Plumbing, Submittals. In addition to the general content specified under Section 22 05 00 – Common Work Results for Plumbing, supply the following submittals:
   1. Insulation
      a. Rigid Fiberglass Insulation
      b. Semi-Rigid Fiberglass Insulation
      c. Elastomeric Insulation
      d. Fireproofing Insulation
   2. Covers and Jackets
   3. Insulation Inserts And Pipe Shields
   4. Accessories
B. Submit a schedule of all insulating materials to be used on the project, including adhesives, fastening methods, fitting materials along with material safety data sheets and intended use of each material. Include manufacturer's technical data sheets indicating density, thermal characteristics, jacket type, and manufacturer's installation instructions.

1.05 REFERENCE STANDARDS

A. ASTM B209 Aluminum and Aluminum Alloy Sheet and Plate

B. ASTM C165 Test Method for Compressive Properties of Thermal Insulations
C. ASTM C177 Heat Flux and Thermal Transmission Properties
D. ASTM C195 Mineral Fiber Thermal Insulation Cement
E. ASTM C240 Cellular Glass Insulation Block
F. ASTM C302 Density of Preformed Pipe Insulation
G. ASTM C303 Density of Preformed Block Insulation
H. ASTM C449 Mineral Fiber Hydraulic Setting Thermal Insulation Cement
I. ASTM C518 Heat Flux and Thermal Transmission Properties
J. ASTM C533 Calcium Silicate Block and Pipe Thermal Insulation
K. ASTM C534 Preformed Flexible Elastomeric Thermal Insulation
L. ASTM C547 Mineral Fiber Preformed Pipe Insulation
M. ASTM C552 Cellular Glass Block and Pipe Thermal Insulation
N. ASTM C553 Mineral Fiber Blanket and Felt Insulation
O. ASTM C578 Preformed, Block Type Cellular Polystyrene Thermal Insulation
P. ASTM C591 Preformed Rigid Cellular Polyurethane Thermal Insulation
Q. ASTM C610 Expanded Perlite Block and Thermal Pipe Insulation
R. ASTM C612 Mineral Fiber Block and Board Thermal Insulation
S. ASTM C921 Properties of Jacketing Materials for Thermal Insulation
T. ASTM C1136 Flexible Low Permeance Vapor Retarders for Thermal Insulation
U. ASTM E84 Surface Burning Characteristics of Building Materials
V. MICA National Commercial & Industrial Insulation Standards
W. NFPA 225 Surface Burning Characteristics of Building Materials
X. UL 723 Surface Burning Characteristics of Building Materials

1.06 QUALITY ASSURANCE

A. Substitution of Materials: Refer to Division 1.
B. Label all insulating products delivered to the construction site with the manufacturer's name and description of materials.

1.07 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified in Section 22 05 00 – Common Work Results for Plumbing.

1.08 DESCRIPTION

A. Furnish and install all insulating materials and accessories as specified or as required for a complete installation. The following types of insulation are specified in this section:
   1. Pipe Insulation
   2. Equipment Insulation
B. Install all insulation in accordance with the latest edition of MICA (Midwest Insulation Contractors Association) Standard and manufacturer's installation instructions. Exceptions to these standards will only be accepted where specifically modified in these specifications, or where prior written approval has been obtained from the Owner’s Project Representative.

1.09 DEFINITIONS

A. Concealed: shafts, furred spaces, space above finished ceilings, utility tunnels and crawl spaces. All other areas, including walk-through tunnels, shall be considered as exposed.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Materials or accessories containing asbestos will not be accepted.

B. Use composite insulation systems (insulation, jackets, sealants, mastics, and adhesives) that have a flame spread rating of 25 or less and smoke developed rating of 50 or less, with the following exceptions:

1. Insulation which is not located in an air plenum may have a flame spread rating not over 25 and a smoke developed rating no higher than 150.

2.02 INSULATION AND JACKETS

A. Manufacturers: Armstrong, Certainteed, Manson, Childers, Dow, Extol, Halstead, H.B. Fuller, Imcoa, Knauf, Owens-Corning, Pittsburgh Corning, Rubatex, Johns-Mansville, Armacell, or approved equal.

B. Insulating materials shall be fire retardant, moisture and mildew resistant, and vermin proof. Insulation shall be suitable to receive jackets, adhesives and coatings as indicated.

C. Rigid Fiberglass Insulation:

1. Minimum nominal density of 3 lbs. per cu. ft., and thermal conductivity of not more than 0.23 at 75 degrees F, minimum compressive strength of 25 PSF at 10% deformation, rated for service to 450 degrees F.
2. White kraft reinforced foil vapor barrier all service jacket, factory applied to insulation with a self-sealing pressure sensitive adhesive lap, maximum permeance of .02 perms and minimum beach puncture resistance of 50 units.

D. Semi-Rigid Fiberglass Insulation:

1. Minimum nominal density of 3 lbs. per cu. ft., thermal conductivity of not more than 0.28 at 75 degrees F, minimum compressive strength of 125 PSF at 10% deformation, rated for service to 450 degrees F. Insulation fibers perpendicular to jacket and scored for wrapping cylindrical surfaces.
2. White kraft reinforced foil vapor barrier all service jacket, factory applied to insulation with a maximum permeance of .02 perms and minimum beach puncture resistance of 50 units.

F. Elastomeric Insulation:

1. Flexible closed cell, minimum nominal density of 5.5 lbs. per cu. ft., thermal conductivity of not more than 0.27 at 75 degrees F, minimum compressive strength of 4.5 psi at 25% deformation, maximum water vapor transmission of 0.17 perm inch, maximum water absorption of 6% by weight, rated for service range of -20 degrees F to 220 degrees F on piping and 180 degrees F where adhered to equipment.

G. Fireproofing Insulation:

1. Mineral fiber with nominal density of 8 lbs. per cu. ft., flame spread index of 15, fuel contribution index of 0, and smoke developed index of 0, thermal conductivity of not more than 0.23 at 75 degrees F.
2. Jacket material shall be the same as jacket for adjacent insulation.

H. PVC Fitting Covers and Jackets:

1. White PVC film, gloss finish one side, semi-gloss other side, FS LP-535E, Composition A, Type II, Grade GU. Ultraviolet inhibited indoor/outdoor grade to be used where exposed to high humidity, ultraviolet radiation, in kitchens or food processing areas or installed outdoors. Jacket thickness to be .02 inch (20 mil).

I. Metal Jackets:

1. .016 inch thick pebble finish aluminum or .010 inch thick stainless steel with safety edge.

2.03 INSULATION INSERTS AND PIPE SHIELDS

A. Manufacturers: B-Line, Pipe Shields, Value Engineered Products

B. Construct inserts with calcium silicate, minimum 140 psi compressive strength. Piping 12" and larger, supplement with high density 600 psi structural calcium silicate insert. Provide galvanized steel shield. Insert and shield to be minimum 180 degree coverage on bottom of supported piping and full 360 degree coverage on clamped piping. On roller mounted piping and piping designed to slide on support, provide additional load distribution steel plate.

C. Where contractor proposes shop/site fabricated inserts and shields, submit schedule of materials, thicknesses, gauges and lengths for each pipe size to demonstrate equivalency to pre-engineered pre-manufactured product described above. On low temperature systems, extruded polystyrene may be substituted for calcium silicate provided insert and shield length and gauge are increased to compensate for lower insulation compressive strength.

D. Precompressed 20# density molded fiberglass blocks, Hamfab, of same thickness as adjacent insulation may be substituted for calcium silicate inserts with one 1"x 6" block for piping through 2-1/2" and three 1" x 6" blocks for piping through 4". Submit shield schedule to demonstrate equivalency to pre-engineered/pre-manufactured product described above.

E. Wood blocks will not be accepted.

2.04 ACCESSORIES

A. All products shall be compatible with surfaces and materials on which they are applied and be suitable for use at operating temperatures of the systems to which they are applied.

B. Adhesives, sealants, and protective finishes shall be as recommended by insulation manufacturer for applications specified.

C. Insulation bands to be 3/4 inch wide, constructed of aluminum or stainless steel. Minimum thickness to be .015 inch for aluminum and .010 inch for stainless steel.

D. Tack fasteners to be stainless steel ring grooved shank tacks.

E. Staples to be clinch style.

F. Insulating cement to be ANSI/ASTM C195, hydraulic setting mineral wool.

G. Finishing cement to be ASTM C449.

H. Fibrous glass or canvas fabric reinforcing shall have a minimum untreated weight of 6 oz./sq. yd.

I. Bedding compounds to be non-shrinking and permanently flexible.

J. Vapor barrier coatings to be non-flammable, fire resistant, polymeric resin.

K. Fungicidal water base coating (Foster 40-20) to be compatible with vapor barrier coating.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install insulation, jackets and accessories in accordance with manufacturer's instructions and under ambient temperatures and conditions recommended by manufacturer. Surfaces to be insulated must be clean and dry.

B. Do not insulate systems or equipment which are specified to be pressure tested or inspected, until testing, inspection and any necessary repairs have been successfully completed.

C. Install insulation with smooth and even surfaces. Poorly fitted joints or use of filler in voids will not be accepted. Cover and seal exposed fiberglass insulation when insulation is terminated, no raw fiberglass insulation is allowed. Provide neat and coated terminations at all nameplates, uninsulated fittings, or at other locations where insulation terminates. Install with longitudinal joints facing wall or ceiling.

D. Install fabric reinforcing without wrinkles. Overlap seams a minimum of 2 inches.

E. Use full-length material (as delivered from manufacturer) wherever possible. Scrap piecing of insulation or pieces cut undersize and stretched to fit will not be accepted.

F. Insulation shall be continuous through sleeves and openings. Vapor barriers shall be maintained continuous through all penetrations.

G. Provide a complete vapor barrier for insulation on the following systems:

1. Cold water (potable and non-potable)
2. Storm Water
3. Equipment piping with a surface temperature below 65 degrees F

3.02 PIPING, VALVE AND FITTING INSULATION

A. General:

1. Install insulation with butt joints and longitudinal seams closed tightly. Provide minimum 2” lap on jacket seams and 2” tape on butt joints, firmly cemented with lap adhesive. Additionally secure with staples along seams and butt joints. Coat staples with vapor barrier mastic on systems requiring vapor barrier.
2. Water supply piping insulation shall be continuous throughout the building and installed adjacent to and within building walls to a point directly behind the fixture that is being supplied.
3. Install insulation continuous through pipe hangers and supports with hangers and supports on the exterior of insulation. Where a vapor barrier is not required, hangers and supports may be attached directly to piping with insulation completely covering hanger or support and jacket sealed at support rod penetration. Where riser clamps are required to be attached directly to piping requiring vapor barrier, extend insulation and vapor barrier jacketing/coating around riser clamp.

B. Insulation Inserts and Pipe Shields:

1. Provide insulation inserts and pipe shields at all hanger and support locations. Inserts may be omitted on 3/4” and smaller copper piping provided 12” long 22 gauge pipe shields are used.

C. Fittings and Valves:

1. Fittings, valves, unions, flanges, couplings and specialties may be insulated with factory molded or built up insulation of the same thickness as adjoining insulation. Cover insulation with fabric reinforcing and mastic or where temperatures do not exceed 150 degrees, PVC fitting covers. Secure PVC fitting covers with tack fasteners and 1-1/2” band of mastic over ends, throat, seams or penetrations. On systems requiring vapor barrier, use vapor barrier mastic.

D. Elastomeric:

1. Where practical, slip insulation on piping during pipe installation when pipe ends are open. Miter cut fittings allowing sufficient length to prevent stretching. Completely seal seams and joints for vapor tight installation. Apply full bed of adhesive to both surfaces.

E. Protective Jackets:

1. Provide a protective PVC jacket for the following insulated piping: Exposed in food handling/kitchen areas, wet areas, where insulation is subject to physical abuse, where insulated piping is exposed to public and lower than 10’-0” above finished floor, or where painted finish is required.
   a. Lap seams and joints a minimum of 2 inches and continuously seal with welding solvent recommended by jacket manufacturer. Lap slip joint ends 4" without fasteners where required to absorb expansion and contraction. For sections where vapor barrier is not required and jacket requires routine removal, tack fasteners may be used.

2. Provide a protective metal jacket for the following insulated piping: Exterior installations.
   a. Lap seams a minimum of 2 inches. Secure with metal bands for end-to-end joints, and rivets or sheet metal screws for longitudinal joints. Rivets, screws, and bands to be constructed of the same material as the jacket. Locate seams on bottom for exterior applications.
3. Provide a protective covering of 2 coats of indoor/outdoor vapor barrier mastic with fabric reinforcing for insulated piping where painted finish is required.

F. Pipe Insulation Schedule:
1. Provide insulation on new and existing remodeled piping as indicated in the following schedule:

Service	**Insulation Types**	**Insulation Thickness by Pipe Size**				
		1” and smaller	1-1/4” to 2”	2-1/2” to 4”	5” to 6”	8” and larger
Hot Water Supply	Rigid Fiberglass	1”	1”	1.5”	1.5”	1.5”
Hot Water Return	Rigid Fiberglass	1”	1”	1.5”		
Cold Water	Rigid Fiberglass	0.5”	0.5”	1”	1”	1”
Tempered Water	Rigid Fiberglass	0.5”	0.5”	1”		
Non-Potable Cold Water	Rigid Fiberglass*	0.5”	0.5”	1”		
All horizontal storm piping, 4'-0" of vertical piping there-after, & roof drain bodies	Rigid Fiberglass	0.5”	0.5”	0.5”	0.5”	0.5”
Clearwater Waste	Rigid Fiberglass*	0.5”	0.5”	0.5”	0.5”	0.5”

* Elastomeric types are acceptable

2. The following piping and fittings are not to be insulated:
   a. Chrome plated exposed supplies and stops (except where specifically noted).
   b. Water hammer arrestors.
   c. Piping unions and flanges for systems not requiring a vapor barrier.

3.03 EQUIPMENT INSULATION

A. Do not insulate over equipment access manholes, fittings, nameplates or ASME stamps. Bevel and seal insulation at these locations.

B. Semi-Rigid Fiberglass:
1. Apply insulation to equipment shells using weld pins, bonding adhesive, banded and wired in place. Fill all joints, seams and depressions with insulating cement to a smooth, even surface. Cover with reinforcing fabric and 2 coats of mastic. Use vapor barrier mastic on systems requiring a vapor barrier.

C. Elastomeric:
1. Apply full cover coat of adhesive to surface to be insulated, insulation and edge butt joints. Place insulation with edge joints firmly butted pressing to surface for full adhesion. Seal seams and joints vapor tight.

D. Equipment Insulation Schedule:
1. Provide equipment insulation as follows:

Equipment	**Insulation Type**	**Thickness**	**Remarks**
Water Meter	Elastomeric	0.5”	Sheet type, fabricated for ease of removal and replacement when service is required.
R.P.B.P.	Elastomeric	0.5”	Sheet type, pipe size type or combination of both. Fabricated for ease of removal and replacement when testing and servicing is required.

END OF SECTION

SECTION 22 11 00
FACILITY WATER DISTRIBUTION

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Base Bid: Unless noted otherwise, the Plumbing Contractor shall provide all labor and materials for a complete system in this specification section.

1.02 SECTION INCLUDES

A. This section contains specifications for plumbing pipe and pipe fittings for this project.
   1. Domestic Water
   2. Dielectric Unions And Flanges
   3. Unions And Flanges
   4. Press Fitting Pipe Connections
   5. Mechanical Grooved Pipe Connections
   6. Piping System Leak Tests

1.03 RELATED WORK

A. Applicable provisions of Division 1 govern work under this section.

B. Section 22 05 14 – Plumbing Specialties

C. Section 22 05 15 – Piping Specialties

D. Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment

1.04 SUBMITTALS

A. Refer to Section 22 05 00 – Common Work Results for Plumbing, Submittals. In addition to the general content specified under Section 22 05 00 – Common Work Results for Plumbing, supply the following submittals:
   1. Domestic Water
   2. Dielectric Unions And Flanges
   3. Unions And Flanges
   4. Press Fitting Pipe Connections
   5. Mechanical Grooved Pipe Connections
   6. Piping System Leak Tests

B. Schedule from the contractor indicating the ASTM or AWWA specification number of the pipe being proposed along with its type and grade if known at the time of submittal, and sufficient information to indicate the type and rating of fittings for each service.

C. Statement from manufacturer on letterhead that pipe furnished meets the ASTM or AWWA specification contained in this section.

1.05 REFERENCE STANDARDS

A. ANSI A21.4 Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water

B. ANSI A21.11 Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

C. ANSI A21.51 Ductile-Iron Pipe, Centrifugally Cast

D. ANSI B16.3 Malleable Iron Threaded Fittings

E. ANSI B16.4 Cast Iron Threaded Fittings

F. ANSI B16.5 Pipe Flanges and Flanged Fittings

G. ANSI B16.22 Wrought Copper and Wrought Copper Alloy Solder Joint Pressure Fittings

H.	ANSI B16.29	Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV
I.	ASTM A53	Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless
J.	ASTM A105	Forgings, Carbon Steel, for Piping Components
K.	ASTM A126	Gray Cast Iron Castings for Valves, Flanges, and Pipe Fittings
L.	ASTM A234	Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
M.	ASTM B32	Solder Metal
N.	ASTM B88	Seamless Copper Water Tube
O.	ASTM B280	Seamless Copper Tube for Air Conditioning and Refrigeration Field Service
P.	ASTM B813	Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube
Q.	ASTM D1785	Poly Vinyl Chloride (PVC) Plastic Pipe
R.	ASTM D2241	Poly Vinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series)
S.	ASTM D2464	Threaded Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80
T.	ASTM D2466	Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40
U.	ASTM D2564	Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings
V.	ASTM D2657	Heat Fusion Joining of Polyolefin Pipe and Fittings
W.	ASTM D2774	Recommended Practice for Underground Installation of Thermoplastic Pressure Piping
X.	ASTM D2855	Making Solvent Cemented Joints with Poly Vinyl Chloride (PVC) Pipe and Fittings
Y.	ASTM D3139	Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
Z.	ASTM D3222	Unmodified Poly Vinylidene Fluoride (PVDF) Molding Extrusion and Coating Materials
AA.	ASTM D4101	Propylene Plastic Injection and Extrusion Materials
BB.	ASTM E84	Surface Burning Characteristics of Building Materials
CC.	ASTM F437	Threaded Chlorinated Poly Vinyl Chloride (CPVC) Plastic Pipe Fittings, Schedule 80
DD.	ASTM F438	Socket Type Chlorinated Poly Vinyl Chloride (CPVC) Plastic Pipe Fittings, Schedule 40
EE.	ASTM F441	Chlorinated Poly Vinyl Chloride (CPVC Plastic Pipe, Schedules 40 and 80
FF.	ASTM F493	Solvent Cements for Chlorinated Poly Vinyl Chloride (CPVC) Plastic Pipe and Fittings
GG.	ASTM F656	Primers for Use in Solvent Cement Joints of Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings
HH.	ASTM F876	Standard Specification for Crosslinked Polyethylene (PEX) Tubing
II.	ASTM F877	Standard Specification for Crosslinked Polyethylene (PEX) Plastic Hot- and Cold-Water Distribution Systems
JJ.	ASTM F1960	Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings
KK.	AWS A5.8	Brazing Filler Metal
LL.	AWWA C104	Cement Mortar Lining for Ductile Iron Pipe and Fittings for Water
MM.	AWWA C105	Polyethylene Encasement for Ductile Iron Piping for Water

NN. AWWA C110 Ductile Iron and Gray Iron Fittings, 3 In. Through 48 In., for Water and Other Liquids

OO. AWWA C111 Rubber Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fittings

PP. AWWA C151 Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds for Water or Other Liquids

QQ. AWWA C153 Ductile Iron Compact Fittings, 3 In. Through 48 In., for Water and Other Liquids

RR. AWWA C600 Installation of Ductile Iron Water Mains and Their Appurtenances

SS. AWWA C651 Disinfecting Water Mains

TT. AWWA C900 Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In., for Water Distribution

UU. AWWA C904 Standard for Crosslinked Polyethylene (PEX) Pressure Pipe, 1/2-inch Through 3-inch, for Water Service

1.06 QUALITY ASSURANCE

A. Substitution of Materials: Refer to Division 1.

B. Order all pipe with each length marked with the name or trademark of the manufacturer and type of pipe; with each shipping unit marked with the purchase order number, metal or alloy designation, temper, size, and name of supplier.

C. Any installed material not meeting the specification requirements must be replaced with material that meets these specifications without additional cost to the owner.

1.07 DESIGN CRITERIA

A. Use only new material, free of defects, rust and scale, and meeting the latest revision of ASTM or AWWA specifications as listed in this specification.

B. Construct all piping for the highest pressures and temperatures in the respective system.

C. Non-metallic piping will be acceptable only for the services indicated. Non-metallic piping will be acceptable in ventilation plenum spaces, including plenum ceilings, when the installed system including insulation and support is certified in compliance with ASTM E84.

D. Where ASTM A53 type F pipe is specified, grade A type E or S, or grade B type E or S may be substituted at Contractor's option. Where the grade or type is not specified, Contractor may choose from those commercially available.

E. Where ASTM B88, type L H (drawn) temper copper tubing is specified, ASTM B88, type K H (drawn) temper copper tubing may be substituted at Contractor's option.

1.08 DELIVERY, STORAGE AND HANDLING

A. Promptly inspect shipments to ensure that the material is undamaged and complies with specifications.

B. Cover pipe to prevent corrosion or deterioration while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade. Protect pipe, tube, and fitting ends so they are not damaged. Where end caps are provided or specified, take precautions so the caps remain in place. Protect fittings, flanges, and unions by storage inside or by durable, waterproof, above ground packaging.

C. Offsite storage agreements will not relieve the contractor from using proper storage techniques.

D. Storage and protection methods must allow inspection to verify products.

PART 2 – PRODUCTS

2.01 DOMESTIC WATER

A. Above Ground:

1. Type L copper water tube, H (drawn) temper, ASTM B88; wrought copper pressure fittings, ANSI B16.22; lead free (<.2%) solder, ASTM B32; flux, ASTM B813; copper phosphorous brazing alloy, AWS A5.8 BCuP. Copper mechanical grooved fittings and couplings on roll grooved pipe may be used in lieu of soldered fittings. Press fitting pipe connections may be used in lieu of soldered fittings. Mechanically formed brazed tee connections may be used in lieu of specified tee fittings for branch takeoffs up to one-half (1/2) the diameter of the main.
2. Stainless Steel Pipe:
   a. 2” and smaller: NSF 61, FM approved ASTM A312, Type 304, Schedule 10S pipe, dimensions conforming to ANSI/ASME B36.19M.
      1) Fittings: Press style fittings with ASTM A312 stainless steel housings, ASTM A276 and A312 outlets and austenitic stainless steel plain or grooved ends, Type 304. Complete with synthetic rubber Grade E seals
   b. 2½” and larger: NSF 61, ASTM A312, Type 304/304L Schedule 10 stainless steel pipe. Roll grooved.
3. Crosslinked Polyethylene (PEX-a Engel Method) plastic pipe and fittings, 1/2” to 2” sizes: ASTM F876, ASTM F877, AWWA C904, with ASTM F1960 cold expansion fittings, rated for a temperature of 180 degrees F at 100 psi, copper tube size (CTS). Transition fittings PEX-to-Metal, one-piece lead free, brass threaded or sweat adapter, with PEX-a reinforcing cold expansion ring. Fittings for PEXa to PEXa connection to be poly plastic. Multiport manifolds with valves shall be accessible. Multiport tees are not required to be accessible. Pipe and fittings by the same manufacturer, Uponor, Rehau, Sioux Chief or equal. Pipe system shall be installed and supported in accordance with the manufacturer’s instructions and include full manufacturer warranty. Fixture connection stub-out piping shall transition to copper piping within wall, before entry into finished space, and include manufactured rigid support. PEXa pipe 1” to 2” shall be provided in straight lengths, coil stock may be used for 1/2” and 3/4” sizes. 1/2" and 3/4” pipe sizes shall be color coded blue for cold water, and red for hot and hot water return water.
4. Chlorinated polyvinyl chloride (CPVC) plastic pipe and fittings, ASTM D2846, SDR 11; NSF 61, rated for a maximum temperature of 180°F. at 100 psi. Copper tube size (CTS) for piping 2” and smaller. Transition fittings for CTS tubing shall have male or female brass connections with integral CPVC socket connections.

B. Below Ground 2½” and Smaller:
   1. Type K copper water tube, O (annealed) temper, ASTM B88; with cast copper pressure fittings, ANSI B16.18; wrought copper pressure fittings, ANSI B16.22; lead free (<.2%) solder, ASTM B32; flux, ASTM B813; or cast copper flared pressure fittings, ANSI B16.26.

C. Below Ground 3" and Larger:
   1. Ductile iron pipe, mechanical or push on joint, thickness Class 52, AWWA C151; with standard thickness cement mortar lining, AWWA C104; ductile iron or gray iron mechanical joint cement mortar lined fittings, Class 250, AWWA C110; ductile iron mechanical joint compact fittings, Class 350, AWWA C153; rubber gasket joints with non-toxic gasket lubricant, AWWA C111. Provide 8 mil tube or sheet polyethylene encasement of iron pipe and pipe fittings, AWWA C105.
   2. PVC pressure pipe, DR 18, Class 150, AWWA C900 and C905; with integral bell and elastomeric gaskets, ASTM D3139. Fittings and fitting polyethylene encasement to be same as noted above for ductile iron.

D. Underground to Interior Building Entrance Piping 3” and larger:
   1. Ductile iron as specified above with factory threaded and machined flanges.

E. Thrust Restraints for Underground Piping:

1. Asphaltic or epoxy coated ductile iron follower gland mechanical joint restraint with gripping wedge restraints and torque limiting twist-off nuts around the pipe circumference, low alloy steel T-bolts and UL listing or Factory Mutual approval. For PVC pipe joint bells, use epoxy or primer coated ductile iron bell and serrated ring restraints or gripping wedge restraints and torque limiting twist-off nuts around the pipe circumference with low alloy steel tie bolts. Restraint to have minimum pressure rating and safety factor equal to or greater than pressure rating and safety factor of pipe and be designed specifically for the pipe material it's applied on.

2.02 DIELECTRIC UNIONS AND FLANGES

A. Manufacturers: Watts, Lochinvar, Wilkins or EPCO Sales, Inc.

B. Dielectric unions 2" and smaller; dielectric flanges 2" and larger; with iron female pipe thread to copper solder joint or brass female pipe thread end connections, non-asbestos gaskets, having a pressure rating of not less than 175 psig at 180 degrees. Watts LF301.

2.03 UNIONS AND FLANGES

A. Unions, flanges and gasket materials to have a pressure rating of not less than 150 psig at 180 degrees. Gasket material for flanges and flanged fittings shall be Teflon type. Treated paper gaskets are not acceptable.

B. 2" and Smaller Steel:

1. ASTM A197/ANSI B16.3 malleable iron unions with brass seats. Use black malleable iron on black steel piping and galvanized malleable iron on galvanized steel piping.

C. 2" and Smaller Copper:

1. ANSI B16.18 cast bronze union coupling or ANSI B15.24 Class 150 cast bronze flanges.

D. 2 ½" and Larger Steel:

1. ASTM A181 or A105, grade 1 hot forged steel flanges of threaded, welding neck, or slip-on pattern on black steel and threaded only on galvanized steel. Use raised face flanges ANSI B16.5 for mating with other raised face flanges or equipment with flat ring or full face gaskets. Use ANSI B16.1 flat face flanges with full face Teflon gaskets for mating with other flat face flanges on equipment. Gaskets shall be Teflon type.

E. 2 ½" and Larger Copper:

1. ANSI B15.24 Class 150 cast bronze flanges with full face Teflon gaskets.

2.04 PRESS FITTING PIPE CONNECTIONS

A. Manufacturer: Viega, Victaulic, Apollo or approved manufacturer.

B. All press fitting materials including o-rings, couplings, fittings and adapters shall be from the same manufacturer.

C. Bronze press fittings for copper tubing shall conform to the material and sizing, requirements of ASME B16.18 or ASME B16.22. O-rings for copper press fittings shall be EPDM. Maximum operating pressure of 200 psi.

2.05 MECHANICAL GROOVED PIPE CONNECTIONS

A. Manufacturers: Anvil, Grinnell, Star, Victaulic

B. Mechanical grooved pipe couplings and fittings, ASTM F1476, may be used with cut groove galvanized steel pipe, cut groove ductile iron pipe or roll groove copper pipe where noted. Mechanical grooved components and assemblies to be rated for minimum 250 psi working pressure.

C. All mechanical grooved pipe material including gaskets, couplings, fittings, and flange adapters shall be from the same manufacturer.

D. Couplings shall be malleable iron, ASTM A47, or ductile iron ASTM A536 with painted finish. Reducing couplings are not acceptable.

E. Fittings used on galvanized steel pipe shall be malleable iron, ASTM A47, or ductile iron A536, with galvanized finish, ASTM A153. Fittings used on ductile iron pipe to be cement mortar lined ductile iron with coal tar coating, ASTM A536; conforming to requirements of AWWA C110/C153 and AWWA C606. Fittings used on copper pipe shall be copper.

F. Gaskets shall be EPDM, ASTM D2000. Gaskets for hot water systems to be flush seal design. Heat treated carbon steel oval neck track bolts and nuts, ASTM A183, with zinc electroplated finish ASTM B633.

G. Flange adapters shall be ductile iron, ASTM A536; except at lug type butterfly valves where standard threaded flanges shall be used.

H. Credit for the inherent flexibility of mechanical grooved pipe connections when used for expansion joints or flexible connectors may be allowed upon specific application by the Contractor. Three flexible couplings at first three connection points both upstream and downstream of pumps may be used in lieu of flexible connectors. Request for expansion joints shall be made in writing and shall include service, location, line size, proposed application and supporting calculations for the intended service.

PART 3 – EXECUTION

3.01 GENERAL

A. Install pipe and fittings in accordance with reference standards, manufacturer's recommendations, and recognized industry practices.

3.02 PREPARATION

A. Cut pipe ends square. Ream ends of piping to remove burrs. Clean scale and dirt from interior and exterior of each section of pipe and fitting prior to assembly.

3.03 ERECTION

A. Install all piping parallel to building walls and ceilings and at heights which do not obstruct any portion of a window, doorway, stairway, or passageway. Where interferences develop in the field, offset, or reroute piping as required to clear such interferences. Coordinate locations of plumbing piping with piping, ductwork, conduit, and equipment of other trades to allow sufficient clearances. In all cases, consult drawings for exact location of pipe spaces, ceiling heights, door and window openings, or other architectural details before installing piping.

B. Where copper or steel piping is embedded in masonry or concrete, provide protective sleeve covering of elastomeric pipe insulation.

C. Install underground warning tape 6"-12" below finished grade above all exterior below ground piping. Where existing underground warning tape is encountered, repair and replace.

D. Maintain piping in clean condition internally during construction.

E. Provide clearance for installation of insulation, access to valves and piping specialties.

F. Provide anchors, expansion joints, swing joints and/or expansion loops so that piping may expand and contract without damage to itself, equipment, or building.

G. Do not route piping through transformer vaults or above transformers, panelboards, or switchboards, including the required service space for this equipment.

H. PEXa pipe joint connections shall be installed per manufacturer's recommendations. Use manufacturer recommended cold-expansion tool for ASTM F 1960 connections.

I. Do not expose PEXa piping to direct sunlight. Provide cover to portions of piping exposed to direct sunlight.

J. Install all valves and piping specialties, including items furnished by others, as specified and/or detailed. Provide access to valves and specialties for maintenance. Make connections to all equipment, fixtures and systems installed by others where same requires the piping services indicated in this section.

3.04 COPPER PIPE JOINTS

A. Remove all slivers and burrs remaining from the cutting operation by reaming and filing both pipe surfaces. Clean fitting and tube with metal brush, emery cloth or sandpaper. Remove residue from the cleaning operation, apply flux and assemble joint to socket stop. Apply flame to fitting until solder melts when placed at joint. Remove flame and feed solder into joint until full penetration of cup and ring of solder appears. Wipe excess solder and flux from joint.

3.05 THREADED PIPE JOINTS

A. Use a thread lubricant or Teflon tape when making joints; no hard setting pipe thread cement or caulking will be allowed.

3.06 SOLVENT WELDED PIPE JOINTS

A. Install in accordance with ASTM D2855 "Making Solvent Cemented Joints With PVC Pipe and Fittings". Saw cut piping square and smooth. Tube cutters may be used if they are fitted with wheels designed for use with PVC/CPVC pipe that do not leave a raised bead on pipe exterior. Support and restrain pipe during cutting to prevent nicks and scratches. Bevel ends 10-15 degrees and deburr interior. Remove dust, drips, moisture, grease, and other superfluous materials from pipe interior and exterior. Check dry fit of pipe and fittings. Reject materials which are out of round or do not fit within close tolerance. Use heavy body solvent cement for large diameter fittings.

B. Maintain pipe, fittings, primer, and cement between 40 and 100 degrees during application and curing. Apply primer and solvent using separate daubers (3" and smaller piping only) or clean natural bristle brushes about 1/2 the size of the pipe diameter. Apply primer to the fitting socket and pipe surface with a scrubbing motion. Check for penetration and reapply as needed to dissolve surface to a depth of 4-5 thousandths. Apply solvent cement to the fitting socket and pipe in an amount greater than needed to fill any gap. While both surfaces are wet, insert pipe into socket fitting with a quarter turn to the bottom of the socket. Solvent cement application and insertion must be completed in less than 1 minute. Minimum of 2 installers is required on piping 4" and larger. Hold joint for 30 seconds or until set. Reference manufacturer’s recommendations for initial set time before handling and for full curing time before pressure testing. Cold weather solvent/cement may be utilized only under unusual circumstances and when specifically approved by the Owner’s Project Representative.

3.07 MECHANICAL JOINT PIPE CONNECTIONS

A. Comply with AWWA C600/C605 installation requirements. Clean pipe end and socket. Clean and lubricate pipe end, socket and gasket with soapy water or gasket lubricant. Place gland and gasket, properly oriented, on pipe end. Insert pipe end fully into socket and press gasket evenly into recess keeping joint straight. Press gland evenly against gasket, insert bolts and hand tighten nuts. Make joint deflection prior to tightening bolts. Evenly tighten bolts in sequence to recommended torque.

3.08 PUSH-ON GASKETED PIPE CONNECTIONS

A. Clean pipe end, bell, gasket seat and gasket of dirt or debris. Coat end of pipe and gasket with gasket lubricant. Ensure pipe is supported off the ground so lubricant does not pick up dirt. Push spigot end into gasket bell with levered pipe joining tool recommended by pipe manufacturer. Large diameter exterior mains may be joined by pushing end of pipe section with backhoe against wood blocking over pipe end. Insert to fully seated position or to reference mark on pipe.

3.09 MECHANICAL GROOVED PIPE CONNECTIONS

A. Use pipe factory grooved in accordance with the coupling manufacturer's specifications or field grooved pipe in accordance with the same specifications using specially designed tools specially designed for the application. Lubricate pipe and coupling gasket, align pipe, and secure joint in accordance with the coupling manufacturer's specifications.

3.10 PRESS FITTING PIPE CONNECTIONS

A. Press fitting connections shall be made in accordance with the manufacturer's installation instructions. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark of the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool approved by the manufacturer.

3.11 MECHANICALLY FORMED TEE FITTINGS

A. Form mechanically extracted collars in a continuous operation, consisting of drilling a pilot hole and drawing out the tube surface to form a collar having a height of not less than three times the thickness of the tube wall. Use an adjustable collaring device. Notch and dimple the branch tube. Braze the joint with neutral flame oxy-acetylene torch, applying heat properly so that pipe and tee do not distort; remove distorted connections.

3.12 DOMESTIC WATER

A. Maintain piping system in clean condition during installation. Remove dirt and debris from assembly of piping as work progresses. Cap open pipe ends where left unattended or subject to contamination.

B. Install exterior water piping below predicted frost level, but in no case less than 6' bury depth to top of pipe. Maintain minimum of 8' horizontal distance between 2½" and larger water piping and sanitary sewer piping. Maintain minimum of 30" horizontal and 12" vertical distance, water on top, between 2" and smaller water piping and sanitary sewer piping. Where water piping crosses a sanitary sewer, provide minimum 18" vertical clearance and waterproof PVC water pipe sleeve (reference sanitary sewer materials) sealed at both ends for distance of 10' from sewer in both directions.

C. Provide thrust restraints for 3" and larger exterior water piping joints, hydrants, caps, plugs, fittings, and bends of 22½ degrees or more. Field apply continuous anti-corrosion coating to rodded restraint components. Protect mechanical joints, nuts, and bolts from concrete cover. Cover with 8 mil sheet or tube polyethylene material sleeve.

D. Install interior water piping with drain valves where indicated and at low points of system to allow complete drainage. Install shutoff valves where indicated and at the base of risers to allow isolation of portions of system for repair. Do not install water piping within exterior walls.

E. Prior to use, isolate and fill system with potable water. Allow to stand 24 hours. Flush each outlet proceeding from the service entrance to the furthest outlet for minimum of 1 minute and until water appears clear. Fill system with a solution of water and chlorine containing at least 50 parts per million of chlorine and allow to stand for 24 hours. Alternately a solution containing at least 200 parts per million of chlorine may be used and allowed to stand for 3 hours. Flush system with potable water until chlorine concentration is no higher than source water level.

F. Wait 24 hours after final flushing. Take samples of water for lab testing. The number and location of samples shall be representative of the system size and configuration and are subject to approval by Engineer. Test shall show the absence of coliform bacteria. If test fails, repeat disinfection and testing procedures until no coliform bacteria are detected. Submit test report indicating date and time of test along with test results.

3.13 UNDERGROUND PIPE WRAP

A. Use for steel piping encased in concrete or underground which is not in a conduit. Remove all dirt and other foreign material from exterior of pipe. Apply primer as recommended by the manufacturer. Use a spiral wrap process for applying tape to the pipe. Repair any breaks in the tape coating caused by the installation process.

3.14 DIELECTRIC UNIONS AND FLANGES

A. Install dielectric unions or flanges at each point where a copper-to-steel pipe connection is required in domestic water systems.

3.15 UNIONS AND FLANGES

A. Install a union or flange at each connection to each piece of equipment and at other items which may require removal for maintenance, repair, or replacement. Where a valve is located at a piece of equipment, locate the flange or union connection on the equipment side of the valve. Concealed unions or flanges are not acceptable.

3.16 PIPING SYSTEM LEAK TESTS

A. Isolate or remove components from system which are not rated for test pressure. Test piping in sections or entire system as required by sequence of construction. Do not insulate or conceal pipe until it has been successfully tested.

B. If required for the additional pressure load under test, provide temporary restraints at fittings or expansion joints. Backfill underground water mains prior to testing with the exception of thrust restrained valves which may be exposed to isolate potential leaks.

C. For hydrostatic tests, use clean water and remove all air from the piping being tested. Measure and record test pressure at the high point in the system.

D. Inspect system for leaks. Where leaks occur, repair the area with new materials and repeat the test. Caulking will not be acceptable.

E. Entire test must be witnessed by the Owner's representative. All pressure tests are to be documented on form included in specification.

System	Test Medium	Initial Test Pressure	Duration	Final Test Pressure	Duration
*Below Ground Domestic Water	Water	N/A		200 psig	2 hr.
Above Ground Domestic Water	Water	N/A		100 psig	8 hr.
Above Ground Non-potable Water	Water	N/A		100 psig	8 hr.
Below Ground Non-potable Water	Water	N/A		100 psig	8 hr.

*Flush and hydrostatically test underground water service piping in accordance with NFPA 13 – Installation of Sprinkler Systems, latest edition. All pressure tests shall be documented on NFPA Contractor's Material and Test Certificate for Underground Piping forms. These forms are to be included in the O&M manual.

END OF SECTION

PIPING SYSTEM TEST REPORT

Date Submitted: _____

Project Name:_____

Location:_____ **Project No:**_____

Contractor:_____

☐ Plumbing ☐ Fire Sprinkler

Test Medium: ☐ Air ☐ Water ☐ Other__

Test performed per specification section No._____

Specified Test Duration _____Hours Specified Test Pressure _____PSIG

System Identification:_____

Describe Location:_____

_____

Test Date:_____

Start Test Time:_____ Initial Pressure:_____PSIG

Stop Test Time:_____ Final Pressure:_____PSIG

Tested By:_____ Witnessed By:_____

Title:_____ Title:_____

Signed:_____ Signed:_____

Date:_____ Date:_____

Comments:_____

_____

_____

_____

_____

_____

SECTION 22 13 00
FACILITY SANITARY SEWERAGE

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Base Bid: Unless noted otherwise, the Plumbing Contractor shall provide all labor and materials for a complete system in this specification section.

1.02 SECTION INCLUDES

A. This section contains specifications for plumbing pipe and pipe fittings for this project.
   1. Sanitary Waste And Vent
   2. Grease Waste And Vent
   3. Piping System Leak Tests

1.03 RELATED WORK

A. Applicable provisions of Division 1 govern work under this section.

B. Section 22 05 14 – Plumbing Specialties

C. Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment

1.04 SUBMITTALS

A. Refer to Section 22 05 00 – Common Work Results for Plumbing, Submittals. In addition to the general content specified under Section 22 05 00 – Common Work Results for Plumbing, supply the following submittals:
   1. Sanitary Waste And Vent
   2. Grease Waste And Vent
   3. Piping System Leak Tests

B. Schedule from the contractor indicating the ASTM or CISPI specification number of the pipe being proposed along with its type and grade if known at the time of submittal, and sufficient information to indicate the type and rating of fittings for each service.

C. Statement from manufacturer on his letterhead that pipe furnished meets the ASTM, or CISPI specification contained in this section.

1.05 REFERENCE STANDARDS

A. ANSI A21.4 Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water

B. ANSI A21.11 Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

C. ANSI A21.51 Ductile-Iron Pipe, Centrifugally Cast

D. ANSI B16.3 Malleable Iron Threaded Fittings

E. ANSI B16.4 Cast Iron Threaded Fittings

F. ANSI B16.5 Pipe Flanges and Flanged Fittings

G. ANSI B16.22 Wrought Copper and Wrought Copper Alloy Solder Joint Pressure Fittings

H. ANSI B16.29 Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV

I. ASTM A53 Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless

J. ASTM A74 Cast Iron Soil Pipe and Fittings

K. ASTM A105 Forgings, Carbon Steel, for Piping Components

L. ASTM A126 Gray Cast Iron Castings for Valves, Flanges, and Pipe Fittings

M. ASTM A234 Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures

N. ASTM A861 High Silicon Iron Pipe and Fittings

O. ASTM A888 Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

P. ASTM B32 Solder Metal

Q. ASTM B306 Copper Drainage Tube (DWV)

R. ASTM B813 Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube

S. ASTM C76 Reinforced Concrete Culvert, Storm Drain and Sanitary Pipe

T. ASTM C564 Standard Specifications for Rubber Gaskets for Cast Iron Soil Pipe and Fittings

U. ASTM C1540 Standard Specifications for Heavy Duty Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings

V. ASTM D1785 Poly Vinyl Chloride (PVC) Plastic Pipe

W. ASTM D2241 Poly Vinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series)

X. ASTM D2466 Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40

Y. ASTM D2564 Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings

Z. ASTM D2665 Poly Vinyl Chloride (PVC) Plastic Drain, Waste and Vent Pipe and Fittings

AA. ASTM D2729 Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings

BB. ASTM D2855 Making Solvent Cemented Joints with Poly Vinyl Chloride (PVC) Pipe and Fittings

CC. ASTM D3034 Type PSM Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings

DD. ASTM D3212 Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals

EE. ASTM D3311 Drain, Waste and Vent (DWV) Plastic Fitting Patterns

FF. ASTM F2618 CPVC Pipe and Fittings for Chemical Waste Drainage

GG. ASTM E84 Surface Burning Characteristics of Building Materials

HH. CISPI 301 Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications

II. CISPI 310 Couplings For Use In Connection With Hubless Cast Iron Soil Pipe And Fittings For Sanitary And Storm Drain, Waste And Vent Piping Applications

1.06 QUALITY ASSURANCE

A. Substitution of Materials: Refer to Division 1.

B. Order all pipe with each length marked with the name or trademark of the manufacturer and type of pipe; with each shipping unit marked with the purchase order number, metal or alloy designation, temper, size, and name of supplier.

C. Any installed material not meeting the specification requirements must be replaced with material that meets these specifications without additional cost to the owner.

1.07 DESIGN CRITERIA

A. Use only new material, free of defects, rust and scale, and meeting the latest revision of ASTM, or CISPI specifications as listed in this specification.

B. Construct all piping for the highest pressures and temperatures in the respective system.

C. Non-metallic piping will be acceptable only for the services indicated. Non-metallic piping will be acceptable in ventilation plenum spaces, including plenum ceilings, when the installed system including insulation and support is certified in compliance with ASTM E84.

D. Where ASTM A53 type F pipe is specified, grade A type E or S, or grade B type E or S may be substituted at Contractor's option. Where the grade or type is not specified, Contractor may choose from those commercially available.

E. Where ASTM B88, type L H (drawn) temper copper tubing is specified, ASTM B88, type K H (drawn) temper copper tubing may be substituted at Contractor's option.

1.08 DELIVERY, STORAGE AND HANDLING

A. Promptly inspect shipments to ensure that the material is undamaged and complies with specifications.

B. Cover pipe to prevent corrosion or deterioration while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade. Protect pipe, tube, and fitting ends so they are not damaged. Where end caps are provided or specified, take precautions so the caps remain in place. Protect fittings, flanges, and unions by storage inside or by durable, waterproof, above ground packaging.

C. Offsite storage agreements will not relieve the contractor from using proper storage techniques.

D. Storage and protection methods must allow inspection to verify products.

PART 2 – PRODUCTS

2.01 SANITARY WASTE AND VENT

A. Interior Above Ground:

1. Hubless cast iron soil pipe and fittings, ASTM A888, CISPI 301; with heavy-duty shielded stainless steel no-hub couplings, CISPI 310, ASTM C1540, ASTM C564, Anaco-Husky HD2000, Clamp-All Hi-Torq 125, Ideal Tridon HD Yellow. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute.

   a. Manufacturers: A B & I Foundry, Charlotte Pipe and Foundry, Tyler Pipe

2. Type M copper water tube, H (drawn) temper, ASTM B88; with cast copper drainage fittings (DWV), ANSI B16.23; wrought copper drainage fittings (DWV), ANSI B16.29; lead free (<.2%) solder, ASTM B32; flux, ASTM B813; copper phosphorous brazing alloy, AWS A5.8 BCuP. Mechanically formed brazed tee connections may be used in lieu of specified tee fittings for vent branch takeoffs up to one-half (1/2) the diameter of the main.

3. PVC plastic pipe, Schedule 40, Class 12454-B (PVC 1120), ASTM D1785; PVC plastic drain, waste and vent pipe and fittings, ASTM D2665; socket fitting patterns, ASTM D3311; primer, ASTM F656; solvent cement, ASTM D2564.

4. CPVC plastic pipe, Schedule 40, ASTM D1784, Class 23447 Type IV, with drainage pattern fittings per ASTM D3311, Solvent cement joints utilizing one step primerless cement as approved by the manufacturer. All fittings and pipe shall be tested and listed in accordance with CAN/ULC S102.2 and tested in general accordance with ASTM E-84/UL723 for flame spread of <25 and smoke development of <50. CPVC pipe and fittings shall be of Charlotte Chem Drain or Spears Lab Waste manufacturers, or equal.

B. Pressurized Interior Above Ground:

1. Type L copper water tube, H (drawn) temper, ASTM B88; with cast copper drainage fittings (DWV), ANSI B16.23; wrought copper drainage fittings (DWV), ANSI B16.29; lead free (<.2%) solder, ASTM B32; flux, ASTM B813.

2. Galvanized steel pipe, Schedule 40, Type F, Grade A, ASTM A53; with cast iron threaded drainage fittings, ASTM B16.12.

3. PVC Plastic pipe, Schedule 40, Class 12454, where temperature will not exceed 130 degrees F, ASTM D1784, ASTM D1785, with solvent cement joint fittings, pressure

rated, ASTM D2466, medium or long sweep radius fittings; primer, ASTM F656; solvent cement, ASTM D2564.

C. Pressurized Below Ground 3" and Smaller:

1. PVC Plastic pipe, schedule 40, Class 12454, where temperature will not exceed 130 degrees F, ASTM D1784, ASTM D1785, with solvent cement joint fittings, pressure rated, ASTM D2466, medium or long sweep radius fittings; primer, ASTM F656; solvent cement, ASTM D2564.

D. Interior Below Ground:

1. Hubless cast iron soil pipe and fittings, ASTM A888, CISPI 301; with heavy-duty shielded stainless steel no-hub couplings, CISPI 310, ASTM C1540, ASTM C564, Anaco-Husky HD2000, Clamp-All Hi-Torq 125, Ideal Tridon HD Yellow. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute.
   a. Manufacturers: A B & I Foundry, Charlotte Pipe and Foundry, Tyler Pipe.
2. Hub and spigot cast iron soil pipe and fittings, service weight, ASTM A74, with neoprene rubber compression gaskets, ASTM C564 and CISPI HSN 85. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute.
   a. Manufacturers: A B & I Foundry, Charlotte Pipe and Foundry, Tyler Pipe
3. PVC plastic pipe, Schedule 40, Class 12454-B (PVC 1120), ASTM D1785; PVC plastic drain, waste and vent pipe and fittings, ASTM D2665; socket fitting patterns, ASTM D3311; primer, ASTM F656; solvent cement, ASTM D2564.
4. CPVC plastic pipe, Schedule 40, ASTM D1784, Class 23447 Type IV, with drainage pattern fittings per ASTM D3311, Solvent cement joints utilizing one step primerless cement as approved by the manufacturer. Fittings and pipe shall be tested and listed in accordance with CAN/ULC S102.2 and tested in general accordance with ASTM E-84/UL723 for flame spread of <25 and smoke development of <50. CPVC pipe and fittings shall be of Charlotte Chem Drain or Spears Lab Waste manufacturers, or equal.

E. Exterior Below Ground 15" and Smaller:

1. Hubless cast iron soil pipe and fittings, ASTM A888, CISPI 301; with heavy-duty shielded stainless steel no-hub couplings, CISPI 310, ASTM C1540, ASTM C564, Anaco-Husky HD2000, Clamp-All Hi-Torq 125, Ideal Tridon HD Yellow. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute.
   a. Manufacturers: A B & I Foundry, Charlotte Pipe and Foundry, Tyler Pipe
2. Hub and spigot cast iron soil pipe and fittings, service weight, ASTM A74, with neoprene rubber compression gaskets, ASTM C564 and CISPI HSN 85. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute.
   a. Manufacturers: A B & I Foundry, Charlotte Pipe and Foundry, Tyler Pipe
3. PVC plastic pipe, Schedule 40, Class 12454-B (PVC 1120), ASTM D1785; PVC plastic drain, waste and vent pipe and fittings, ASTM D2665; socket fitting patterns, ASTM D3311; primer, ASTM F656; solvent cement, ASTM D2564.
4. Type PSM PVC sewer pipe and socket fittings, SDR 35, Class 12454-B (PVC 1120), ASTM D3034; primer, ASTM F656; solvent cement, ASTM 2564; or integral bell and flexible elastomeric seal, ASTM D3212.

2.02 GREASE WASTE AND VENT

A. Interior Above Ground:

1. CPVC plastic piping equal to Spears Lab Waste shall be manufactured from CPVC Type IV, ASTM Cell Classification 23447. Schedule 40 CPVC manufactured to dimensional requirements of ASTM F441. CAN/ULC S102.2. Listed for flame spread and smoke development with rating designated on the pipe marking. All pipe markings shall be accompanied by a yellow stripe for identification of CPVC chemical waste

system. All fittings shall be CPVC drainage patterns meeting the requirements of ASTM D3311 and specialty patterns according to the Manufacturer's specification. All molded fittings shall be CAN/ULC S102.2 Listed for flame spread and smoke development and rating designated on the original package labeling. Joining method for pipe and fittings shall be solvent cement welding. Solvent cement shall be a "one-step" primer less type CPVC cement designated by the system manufacturer, specially formulated for resistance to corrosive chemicals and manufactured in accordance with ASTM F493. Mechanical connections for special equipment connection or transitions to other system materials shall be as specified by the CPVC system manufacturer. All pipe, fittings and cement shall be supplied together as a complete system. Installation shall be in accordance with the manufacturer's instructions and all applicable codes.

B. Interior Below Ground:

1. CPVC plastic piping equal to Spears Lab Waste shall be manufactured from CPVC Type IV, ASTM Cell Classification 23447. Schedule 40 CPVC manufactured to dimensional requirements of ASTM F441. CAN/ULC S102.2. Listed for flame spread and smoke development with rating designated on the pipe marking. All pipe markings shall be accompanied by a yellow stripe for identification of CPVC chemical waste system. All fittings shall be CPVC drainage patterns meeting the requirements of ASTM D3311 and specialty patterns according to the Manufacturer's specification. All molded fittings shall be CAN/ULC S102.2 Listed for flame spread and smoke development and rating designated on the original package labeling. Joining method for pipe and fittings shall be solvent cement welding. Solvent cement shall be a "one-step" primer less type CPVC cement designated by the system manufacturer, specially formulated for resistance to corrosive chemicals and manufactured in accordance with ASTM F493. Mechanical connections for special equipment connection or transitions to other system materials shall be as specified by the CPVC system manufacturer. All pipe, fittings and cement shall be supplied together as a complete system. Installation shall be in accordance with the manufacturer's instructions and all applicable codes.

PART 3 – EXECUTION

3.01 GENERAL

A. Install pipe and fittings in accordance with reference standards, manufacturer's recommendations and recognized industry practices.

3.02 PREPARATION

A. Cut pipe ends square. Ream ends of piping to remove burrs. Clean scale and dirt from interior and exterior of each section of pipe and fitting prior to assembly.

3.03 ERECTION

A. Install all piping parallel to building walls and ceilings and at heights which do not obstruct any portion of a window, doorway, stairway, or passageway. Where interferences develop in the field, offset or reroute piping as required to clear such interferences. Coordinate locations of plumbing piping with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. In all cases, consult drawings for exact location of pipe spaces, ceiling heights, door and window openings, or other architectural details before installing piping.

B. Where copper or steel piping is embedded in masonry or concrete, provide protective sleeve covering of elastomeric pipe insulation.

C. Install underground warning tape 6"-12" below finished grade above all exterior below ground piping. Where existing underground warning tape is encountered, repair and replace.

D. Maintain piping in clean condition internally during construction.

E. Do not route piping through transformer vaults or above transformers, panelboards or switchboards, including the required service space for this equipment.

F. Install all valves and piping specialties, including items furnished by others, as specified and/or detailed. Provide access to valves and specialties for maintenance. Make

connections to all equipment, fixtures and systems installed by others where same requires the piping services indicated in this section.

G. Install heavy-duty transition coupling when joining no-hub cast iron and PVC pipe, ASTM C1460 with ASTM C564 gasket, Husky SD4200 PVCxCI.

3.04 COPPER PIPE JOINTS

A. Remove all slivers and burrs remaining from cutting operation by reaming and filing both pipe surfaces. Clean fitting and tube with metal brush, emery cloth or sandpaper. Remove residue from cleaning operation, apply flux and assemble joint to socket stop. Apply flame to fitting until solder melts when placed at joint. Remove flame and feed solder into joint until full penetration of cup and ring of solder appears. Wipe excess solder and flux from joint.

3.05 THREADED PIPE JOINTS

A. Use a thread lubricant or Teflon tape when making joints; no hard setting pipe thread cement or caulking will be allowed.

3.06 SOLVENT WELDED PIPE JOINTS

A. Install in accordance with ASTM D2855 "Making Solvent Cemented Joints With PVC Pipe and Fittings". Saw cut piping square and smooth. Tube cutters may be used if they are fitted with wheels designed for use with PVC/CPVC pipe that do not leave a raised bead on pipe exterior. Support and restrain pipe during cutting to prevent nicks and scratches. Bevel ends 10-15 degrees and deburr interior. Remove dust, drips, moisture, grease and other superfluous materials from pipe interior and exterior. Check dry fit of pipe and fittings. Reject materials which are out of round or do not fit within close tolerance. Use heavy body solvent cement for large diameter fittings.

B. Maintain pipe, fittings, primer and cement between 40 and 100 degrees during application and curing. Apply primer and solvent using separate daubers (3" and smaller piping only) or clean natural bristle brushes about 1/2 the size of the pipe diameter. Apply primer to the fitting socket and pipe surface with a scrubbing motion. Check for penetration and reapply as needed to dissolve surface to a depth of 4-5 thousandths. Apply solvent cement to the fitting socket and pipe in an amount greater than needed to fill any gap. While both surfaces are wet, insert pipe into socket fitting with a quarter turn to bottom of socket. Solvent cement application and insertion must be completed in less than 1 minute. Minimum of 2 installers is required on piping 4" and larger. Hold joint for 30 seconds or until set. Reference manufacturer's recommendations for initial set time before handling and for full curing time before pressure testing.

C. Cold weather solvent/cement may be utilized only under unusual circumstances and when specifically approved by the Owner's Project Representative. Solvent welded pipe joints are not permitted to be made below 40 degrees.

3.07 MECHANICAL HUBLESS PIPE CONNECTIONS

A. Place the gasket on the end of one pipe or fitting and the clamp assembly on the end of the other pipe or fitting. Firmly seat the pipe or fitting ends against the integrally molded shoulder inside the neoprene gasket. Slide the clamp assembly into position over the gasket. Tighten fasteners to manufacturers recommended torque.

3.08 SANITARY WASTE AND VENT

A. Verify invert elevations and building elevations prior to installation. Install exterior piping pitched to drain at indicated elevations and slope. Install interior piping pitched to drain at minimum slope of 1/4" per foot where possible and in no case less than 1/8" per foot for piping 4" and larger.

B. Install exterior piping below predicted frost level and not less than 5' bury depth to top of pipe wherever possible. Where piping is located above predicted frost level, provide frost protection.

C. Flush piping inlets (floor drains, hub drains, mop basins, fixtures, etc.) with high flow of water at completion of project to demonstrate full flow capacity. Remove blockages and make necessary repairs where flow is found to be impeded.

3.09 PIPING SYSTEM LEAK TESTS

A. For hydrostatic tests, use clean water and remove all air from the piping being tested. Measure and record test pressure at the high point in the system.

B. Inspect system for leaks. Where leaks occur, repair the area with new materials and repeat the test; caulking will not be acceptable.

C. Entire test must be witnessed by the Owner's representative. All pressure tests are to be documented.

System	Test Medium	Initial Test Pressure	Initial Test Duration	Final Test Pressure	Final Test Duration
Sanitary Waste and Vent	Water	N/A		10' water	2 hr.
Pressurized Sanitary Waste & Vent	Water	N/A		100 psig	2 hr.
Grease Waste and Vent	Water	N/A		10' water	2 hr.

END OF SECTION

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SECTION 22 14 00
FACILITY STORM DRAINAGE

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Base Bid: Unless noted otherwise, the Plumbing Contractor shall provide all labor and materials for a complete system in this specification section.

1.02 SECTION INCLUDES

A. This section contains specifications for plumbing pipe and pipe fittings for this project.
   1. Storm And Clearwater Waste And Vent
   2. Piping System Leak Tests

1.03 RELATED WORK

A. Applicable provisions of Division 1 govern work under this section.

B. Section 22 05 14 – Plumbing Specialties

C. Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment

1.04 SUBMITTALS

A. Refer to Section 22 05 00 – Common Work Results for Plumbing, Submittals. In addition to the general content specified under Section 22 05 00 – Common Work Results for Plumbing, supply the following submittals:
   1. Storm And Clearwater Waste And Vent
   2. Piping System Leak Tests

B. Schedule from the contractor indicating the ASTM or CISPI specification number of the pipe being proposed along with its type and grade if known at the time of submittal, and sufficient information to indicate the type and rating of fittings for each service.

C. Statement from manufacturer on his letterhead that pipe furnished meets the ASTM or CISPI specification contained in this section.

1.05 REFERENCE STANDARDS

A. ANSI A21.4 Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water

B. ANSI A21.11 Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

C. ANSI A21.51 Ductile-Iron Pipe, Centrifugally Cast

D. ANSI B16.3 Malleable Iron Threaded Fittings

E. ANSI B16.4 Cast Iron Threaded Fittings

F. ANSI B16.5 Pipe Flanges and Flanged Fittings

G. ANSI B16.22 Wrought Copper and Wrought Copper Alloy Solder Joint Pressure Fittings

H. ANSI B16.29 Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings – DWV

I. ASTM A53 Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless

J. ASTM A74 Cast Iron Soil Pipe and Fittings

K. ASTM A105 Forgings, Carbon Steel, for Piping Components

L. ASTM A126 Gray Cast Iron Castings for Valves, Flanges, and Pipe Fittings

M. ASTM A234 Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures

N. ASTM A888 Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain,

		Waste, and Vent Piping Applications
O.	ASTM B32	Solder Metal
P.	ASTM B88	Seamless Copper Water Tube
Q.	ASTM B306	Copper Drainage Tube (DWV)
R.	ASTM B813	Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube
S.	ASTM C76	Reinforced Concrete Culvert, Storm Drain and Sanitary Pipe
T.	ASTM C425	Compression Joints for Vitrified Clay Pipe & Fittings
U.	ASTM C443	Joints for Circular Concrete Pipe Sewer and Culvert Pipe Using Rubber Gaskets
V.	ASTM C564	Rubber Gaskets for Cast Iron Soil Pipe and Fittings
W.	ASTM C700	Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated
X.	ASTM C1540	Heavy Duty Shielded Couplings for Joining Hubless Cast Iron Soil Pipe and Fittings
Y.	ASTM D1785	Poly Vinyl Chloride (PVC) Plastic Pipe
Z.	ASTM D2321	Underground Installation of Flexible Thermoplastic Sewer Pipe
AA.	ASTM D2241	Poly Vinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series)
BB.	ASTM D2464	Threaded Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80
CC.	ASTM D2466	Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40
DD.	ASTM D2564	Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings
EE.	ASTM D2665	Poly Vinyl Chloride (PVC) Plastic Drain, Waste and Vent Pipe and Fittings
FF.	ASTM D2729	Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings
GG.	ASTM D2855	Making Solvent Cemented Joints with Poly Vinyl Chloride (PVC) Pipe and Fittings
HH.	ASTM D3034	Type PSM Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings
II.	ASTM D3212	Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
JJ.	ASTM D3311	Drain, Waste and Vent (DWV) Plastic Fitting Patterns
KK.	ASTM D4101	Propylene Plastic Injection and Extrusion Materials
LL.	ASTM E84	Surface Burning Characteristics of Building Materials
MM.	ASTM F405	Corrugated Polyethylene (PE) Tubing and Fittings
NN.	ASTM F656	Primers for Use in Solvent Cement Joints of Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings
OO.	CISPI 301	Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications
PP.	CISPI 310	Couplings For Use In Connection With Hubless Cast Iron Soil Pipe And Fittings For Sanitary And Storm Drain, Waste And Vent Piping Applications

1.06 QUALITY ASSURANCE

A. Substitution of Materials: Refer to Division 1.

B. Order all pipe with each length marked with the name or trademark of the manufacturer and type of pipe; with each shipping unit marked with the purchase order number, metal or alloy designation, temper, size, and name of supplier.

C. Any installed material not meeting the specification requirements must be replaced with material that meets these specifications without additional cost to the owner.

1.07 DESIGN CRITERIA

A. Use only new material, free of defects, rust and scale, and meeting the latest revision of ASTM or CISPI specifications as listed in this specification.

B. Construct all piping for the highest pressures and temperatures in the respective system.

C. Non-metallic piping will be acceptable only for the services indicated. Non-metallic piping will be acceptable in ventilation plenum spaces, including plenum ceilings, when the installed system including insulation and support is certified in compliance with ASTM E84.

D. Where ASTM A53 type F pipe is specified, grade A type E or S, or grade B type E or S may be substituted at Contractor's option. Where the grade or type is not specified, Contractor may choose from those commercially available.

E. Where ASTM B88, type L H (drawn) temper copper tubing is specified, ASTM B88, type K H (drawn) temper copper tubing may be substituted at Contractor's option.

1.08 DELIVERY, STORAGE AND HANDLING

A. Promptly inspect shipments to ensure that the material is undamaged and complies with specifications.

B. Cover pipe to prevent corrosion or deterioration while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade. Protect pipe, tube, and fitting ends so they are not damaged. Where end caps are provided or specified, take precautions so the caps remain in place. Protect fittings, flanges, and unions by storage inside or by durable, waterproof, above ground packaging.

C. Offsite storage agreements will not relieve the contractor from using proper storage techniques.

D. Storage and protection methods must allow inspection to verify products.

PART 2 – PRODUCTS

2.01 STORM AND CLEARWATER WASTE AND VENT

A. Interior Above Ground:

1. Hubless cast iron soil pipe and fittings, ASTM A888, CISPI 301; with heavy-duty shielded stainless steel no-hub couplings, CISPI 310, ASTM C1540, ASTM C564, Anaco-Husky HD2000, Clamp-All Hi-Torq 125, Ideal Tridon HD Yellow. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute.

   a. Manufacturers: A B & I Foundry, Charlotte Pipe and Foundry, Tyler Pipe

2. Type M copper water tube, H (drawn) temper, ASTM B88; with cast copper drainage fittings (DWV), ANSI B16.23; wrought copper drainage fittings (DWV), ANSI B16.29; lead free (<.2%) solder, ASTM B32; flux, ASTM B813; copper phosphorous brazing alloy, AWS A5.8 BCuP. Mechanically formed brazed tee connections may be used in lieu of specified tee fittings for clearwater waste vent branch takeoffs up to one-half (1/2) the diameter of the main.

3. Copper drainage tube (DWV), ASTM B306; with cast copper drainage fittings (DWV), ANSI B16.23; wrought copper drainage fittings (DWV), ANSI B16.29; lead free (<.2%) solder, ASTM B32; flux, ASTM B813; copper phosphorous brazing alloy, AWS A5.8 BCuP. Mechanically formed brazed tee connections may be used in lieu of specified tee fittings for clearwater waste vent branch takeoffs up to one-half (1/2) the diameter of the main.

4. PVC plastic pipe, Schedule 40, Class 12454-B (PVC 1120), ASTM D1785; PVC plastic drain, waste and vent pipe and fittings, ASTM D2665; fitting patterns, ASTM D3311; primer, ASTM F656; solvent cement, ASTM D2564.

B. Pressurized Interior Above Ground:

1. Type L copper water tube, H (drawn) temper, ASTM B88; with cast copper drainage fittings (DWV), ANSI B16.23; wrought copper drainage fittings (DWV), ANSI B16.29; lead free (<.2%) solder, ASTM B32; flux, ASTM B813.
2. Galvanized steel pipe, Schedule 40, Type F, Grade A, ASTM A53; with cast iron threaded drainage fittings, ASTM B16.12.
3. PVC Plastic pipe, Schedule 40, Class 12454, where temperature will not exceed 130 degrees F, ASTM D1784, ASTM D1785, with solvent cement joint fittings, pressure rated, ASTM D2466, medium or long sweep radius fittings; primer, ASTM F656; solvent cement, ASTM D2564.

C. Pressurized Below Ground 3" and Smaller:

1. PVC Plastic pipe, schedule 40, Class 12454, where temperature will not exceed 130 degrees F, ASTM D1784, ASTM D1785, with solvent cement joint fittings, pressure rated, ASTM D2466, medium or long sweep radius fittings; primer, ASTM F656; solvent cement, ASTM D2564.

D. Interior Below Ground 15" and Smaller:

1. Hubless cast iron soil pipe and fittings, ASTM A888, CISPI 301; with heavy-duty shielded stainless steel no-hub couplings, CISPI 310, ASTM C1540, ASTM C564, Anaco-Husky HD2000, Clamp-All Hi-Torq 125, Ideal Tridon HD Yellow. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute.
   a. Manufacturers: A B & I Foundry, Charlotte Pipe and Foundry, Tyler Pipe
2. Cast iron soil pipe and fittings, hub and spigot, service weight, CISPI 301, ASTM A74; ASTM A888 with neoprene rubber compression gaskets, ASTM C564 and CISPI HSN 85. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Pipe Institute.
   a. Manufacturers: A B & I Foundry, Charlotte Pipe and Foundry, Tyler Pipe
3. PVC plastic pipe, Schedule 40, Class 12454-B (PVC 1120), ASTM D1785; PVC plastic drain, waste and vent pipe and fittings, ASTM D2665; fitting patterns, ASTM D3311; primer, ASTM F656; solvent cement, ASTM D2564.

E. Exterior Below Ground 15" and Smaller:

1. Hubless cast iron soil pipe and fittings, ASTM A888, CISPI 301; with heavy-duty shielded stainless steel no-hub couplings, CISPI 310, ASTM C1540, ASTM C564, Anaco-Husky HD2000, Clamp-All Hi-Torq 125, Ideal Tridon HD Yellow. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute.
   a. Manufacturers: A B & I Foundry, Charlotte Pipe and Foundry, Tyler Pipe
2. Cast iron soil pipe and fittings, hub and spigot, service weight, CISPI 301, ASTM A74; ASTM A888 with neoprene compression rubber gaskets, ASTM C564 and CISPI HSN 85. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Pipe Institute.
   a. Manufacturers: A B & I Foundry, Charlotte Pipe and Foundry, Tyler Pipe
3. Extra strength vitrified clay bell and spigot pipe and fittings, ATM C700. Joints shall meet or exceed ASTM C425.
4. PVC plastic pipe, Schedule 40, Class 12454-B (PVC 1120), ASTM D1785; PVC plastic drain, waste and vent pipe and fittings, ASTM D2665; fitting patterns, ASTM D3311; primer, ASTM F656; solvent cement, ASTM 2564.
5. Type PSM PVC sewer pipe and fittings, SDR 35, Class 12454-B (PVC 1120), ASTM D3034; primer, ASTM F656; solvent cement, ASTM 2564; or integral bell and flexible elastomeric seal, ASTM D3212.

PART 3 – EXECUTION

3.01 GENERAL

A. Install pipe and fittings in accordance with reference standards, manufacturer's recommendations and recognized industry practices.

3.02 PREPARATION

A. Cut pipe ends square. Ream ends of piping to remove burrs. Clean scale and dirt from interior and exterior of each section of pipe and fitting prior to assembly.

3.03 ERECTION

A. Install all piping parallel to building walls and ceilings and at heights which do not obstruct any portion of a window, doorway, stairway, or passageway. Where interferences develop in the field, offset or reroute piping as required to clear such interferences. Coordinate locations of plumbing piping with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. In all cases, consult drawings for exact location of pipe spaces, ceiling heights, door and window openings, or other architectural details before installing piping.

B. Where copper or steel piping is embedded in masonry or concrete, provide protective sleeve covering of elastomeric pipe insulation.

C. Install underground warning tape 6"-12" below finished grade above all exterior below ground piping. Where existing underground warning tape is encountered, repair and replace.

D. Maintain piping in clean condition internally during construction.

E. Provide clearance for installation of insulation, access to valves and piping specialties.

F. Do not route piping through transformer vaults or above transformers, panelboards or switchboards, including the required service space for this equipment.

G. Install all valves and piping specialties, including items furnished by others, as specified and/or detailed. Provide access to valves and specialties for maintenance. Make connections to all equipment, fixtures and systems installed by others where same requires the piping services indicated in this section.

H. Install heavy-duty transition coupling when joining no-hub cast iron and PVC pipe, ASTM C1460 with ASTM C564 gasket, Husky SD4200 PVCxCI.

3.04 COPPER PIPE JOINTS

A. Remove all slivers and burrs remaining from the cutting operation by reaming and filing both pipe surfaces. Clean fitting and tube with metal brush, emery cloth or sandpaper. Remove residue from the cleaning operation, apply flux and assemble joint to socket stop. Apply flame to fitting until solder melts when placed at joint. Remove flame and feed solder into joint until full penetration of cup and ring of solder appears. Wipe excess solder and flux from joint.

3.05 THREADED PIPE JOINTS

A. Use a thread lubricant or Teflon tape when making joints; no hard setting pipe thread cement or caulking will be allowed.

3.06 SOLVENT WELDED PIPE JOINTS

A. Install in accordance with ASTM D2855 "Making Solvent Cemented Joints With PVC Pipe and Fittings". Saw cut piping square and smooth. Tube cutters may be used if they are fitted with wheels designed for use with PVC/CPVC pipe that do not leave a raised bead on pipe exterior. Support and restrain pipe during cutting to prevent nicks and scratches. Bevel ends 10-15 degrees and deburr interior. Remove dust, drips, moisture, grease and other superfluous materials from pipe interior and exterior. Check dry fit of pipe and fittings. Reject materials which are out of round or do not fit within close tolerance. Use heavy body solvent cement for large diameter fittings.

B. Maintain pipe, fittings, primer and cement between 40 and 100 degrees during application and curing. Apply primer and solvent using separate daubers (3" and smaller piping only) or clean natural bristle brushes about 1/2 the size of the pipe diameter. Apply primer to the fitting socket and pipe surface with a scrubbing motion. Check for penetration and reapply as needed to dissolve surface to a depth of 4-5 thousandths. Apply solvent cement to the fitting socket and pipe in an amount greater than needed to fill any gap. While both surfaces are wet, insert pipe into socket fitting with a quarter turn to the bottom of the socket. Solvent cement application and insertion must be completed in less than 1 minute. Minimum of 2 installers is required on piping 4" and larger. Hold joint for 30 seconds or until set. Reference manufacturer's recommendations for initial set time before handling and for full curing time before pressure testing.

C. Cold weather solvent/cement may be utilized only under unusual circumstances and when specifically approved by the Owner's Project Representative. Solvent welded pipe joints are not permitted to be made below 40 degrees.

3.07 MECHANICAL HUBLESS PIPE CONNECTIONS

A. Place the gasket on the end of one pipe or fitting and the clamp assembly on the end of the other pipe or fitting. Firmly seat the pipe or fitting ends against the integrally molded shoulder inside the neoprene gasket. Slide the clamp assembly into position over the gasket. Tighten fasteners to manufacturer's recommended torque.

3.08 STORM AND CLEARWATER WASTE AND VENT

A. Verify invert elevations and building elevations prior to installation.

B. Install piping pitched to drain at indicated elevations and slope. Install drain piping pitched to drain at minimum slope of 1/8" per foot, unless indicated otherwise on the drawings.

C. Install exterior piping below predicted frost level and not less than 5' bury depth to top of pipe wherever possible. Where piping is located above predicted frost level, provide frost protection.

3.09 PIPING SYSTEM LEAK TESTS

A. For hydrostatic tests, use clean water and remove all air from the piping being tested. Measure and record test pressure at the high point in the system.

B. Inspect system for leaks. Where leaks occur, repair the area with new materials and repeat the test. Caulking will not be acceptable.

C. Entire test must be witnessed by the owner's representative. All pressure tests are to be documented.

System	Test Medium	Initial Test Pressure	Duration	Final Test Pressure	Duration
Clearwater Waste and Vent	Water	N/A		10' water	2 hr.
Storm and Clearwater Waste	Water	N/A		10' water	2 hr.
Pressurized Storm/Clearwater Waste	Water	N/A		100 psig	2 hr.

END OF SECTION

SECTION 22 30 00
PLUMBING EQUIPMENT

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Base Bid: Unless noted otherwise, the Plumbing Contractor shall provide all labor and materials for a complete system in this specification section.

B. See Schedules and Details on Drawings for models and capacities.

1.02 SECTION INCLUDES

A. This section includes specifications for water heaters, water softeners, pumps and other equipment used for plumbing applications.

1. High Efficiency Commercial Gas Fired Water Heaters
2. Sumps
3. Sump Pumps
4. In-Line Electronically Commutated Motor Pumps
5. Expansion Tanks
6. Water Softener

1.03 RELATED WORK

A. Applicable provisions of Division 1 shall govern work under this section.

B. Section 22 05 13 - Common Motor Requirements for Plumbing

C. Section 22 05 15 - Piping Specialties

D. Section 22 05 23 - General-Duty Valves for Plumbing Piping

E. Section 22 07 00 - Plumbing Insulation

F. Division 26 - Electrical

1.04 SUBMITTALS

A. Refer to Section 22 05 00 - Common Work Results for Plumbing, Submittals. In addition to the general content specified under Section 22 05 00 – Common Work Results for Plumbing, supply the following submittals:

1. High Efficiency Commercial Gas Fired Water Heaters
2. Sumps
3. Sump Pumps
4. In-Line Electronically Commutated Motor Pumps
5. Expansion Tanks
6. Water Softener

B. Include data concerning dimensions, capacities, materials of construction, ratings, certifications, weights, pump curves with net positive suction head requirements, manufacturer's installation requirements, manufacturer's performance limitations, and appropriate identification.

1.05 QUALITY ASSURANCE

A. Substitution of Materials: Refer to Division 1.

B. Plumbing products requiring approval by the State of Wisconsin Dept. of Safety & Professional Services must be approved or have pending approval at the time of shop drawing submission.

1.06 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under in Section 22 05 00 – Common Work Results for Plumbing.

PART 2 – PRODUCTS

2.01 HIGH EFFICIENCY COMMERCIAL GAS FIRED WATER HEATERS

A. Manufacturers: A.O. Smith, Bradford White, Bock, Lochinvar, State.

B. Type: Gas fired sealed combustion condensing commercial storage water heater, minimum 92% thermal efficiency. Design to be AGA certified with 3 year tank warranty and 1 year parts warranty.

C. Tank: Steel glass lined tank rated for 150 psig complete with multiple removable magnesium anode rods or single impressed current anode rod, submerged combustion chamber, 4” tank access hand hole, foam insulation, painted steel jacket, brass drain valve and temperature and pressure relief valve.

D. Burner: Top mounted down fired premix low NOx power burner.

E. Controls: 120 volt, 1 phase, 60 Hz electronic controls, intermittent spark or hot surface ignition, operating thermostat with 110°-180° F adjustable temperature control, energy cutoff with manual reset, blower pressure switch, gas valve and pressure regulator.

F. Vent: 4” CPVC combustion air intake and flue gas outlet with solvent weld fittings, system certified to UL 1738.

G. Condensate Drain: PVC with solvent weld fittings. Drain neutralizer package.

2.02 SUMPS

A. Fiberglass sump basin constructed of 20-30% fiberglass and 70-80% polyester resin with no fillers, anti-flotation flange, minimum wall design safety factor of two, complete with tapped top flange and side hub fittings as required, steel bottom insert on all basins over 10’ depth or where required to mate with pump system. Include solid bolted steel with neoprene gasket and inspection access plate, access plate with discharge pipe flange for each pump and control and vent flange where required. Minimum steel cover thickness 3/8” and as required for anticipated load. All fittings to be gas and airtight. Minimum sump wall thickness as follows:

Wall Thickness (Inches)

Diameter	24	30	36	42	48	60	72
Max. 10' Depth	3/16	1/4	1/4	1/4	5/16	5/16	3/8
Max. 15' Depth	1/4	5/16	5/16	5/16	3/8	3/8	7/16
Max. 20' Depth	5/16	5/16	3/8	3/8	7/16	1/2	1/2

B. Precast reinforced concrete manhole sections, ASTM C478. Construct base of 6" thick precast reinforced concrete or 8" thick cast in place concrete. Construct top of precast reinforced concrete or 6" thick reinforced concrete slab. Seal between sections with rubber ring gaskets, ASTM C443, or plastic preformed gasket material. Seal pipe penetrations with flexible watertight rubber gasketed seals. Provide bolted galvanized steel or aluminum gasketed cover with inspection access plate, access plate with discharge pipe flange for each pump and control and vent flange where required.

2.03 SUMP PUMPS

A. Manufacturer: Aurora/Hydromatic, Gould, Little Giant, Myers, Paco, Stancor, Sta-Rite, Weil, Zoeller.

B. Type: Submersible pumps constructed of epoxy coated cast iron shell, cast iron volute, semi-open non-clog cast iron, bronze or thermoplastic impeller, stainless steel shaft, stainless steel fasteners, upper and lower ball bearings, oil lubricated or factory sealed grease lubricated, and ceramic mechanical seal.

C. Motor: Hermetically sealed, capacitor start, with built-in thermal overload protection sized for non-overloading over the entire pump curve.

D. SP-1 Elevator Sump Pump Controls:

1. Single On/Off float switch, UL listed.
2. NEMA 1 indoor alarm panel with warning light, horn, silence switch, test switch and high level alarm switch, UL listed.
3. Combination magnetic starter with fused disconnect switch, HOA switch, run light, resettable overload heaters, NEMA 1, UL listed.
4. Accessories:
   a. 15’ power cord.
5. Discharge check valve, fullport ball valve and union for each pump.
6. Dual mechanical seals, seal leak detector probe and warning light in control panel.
7. Oil smart alarm, oil smart pump switch.
8. Refer to schedules and details on plumbing drawings for additional information.

2.04 IN-LINE ELECTRONICALLY COMMUTATED MOTOR PUMPS

A. Manufacturer: Bell and Gossett, Grundfos, Wilo.

B. Type: Horizontal single stage close coupled wet rotor in-line pumps, 125 psig maximum working pressure at operating temperature of 225° F continuous. The manufacturer shall certify all pump ratings. All pumps to operate without excessive noise or vibration.

C. Casing: Bronze or stainless steel; flanged suction and discharge connection.

D. Impeller: Stainless steel or thermoplastic, keyed to the shaft, single suction enclosed type, hydraulically and dynamically balanced.

E. Bearings: Carbon or stainless steel sleeve bearings.

F. Shaft: Stainless steel or ceramic.

G. Seal: Stainless steel rotor and stator.

H. Motor: Synchronous, permanent magnet, electronically commutated motor (ECM) sized for non-overloading over the entire pump curve. Variable speed with minimum three standard operating modes, LED display. Furnish each pump and motor with a nameplate giving the manufacturer's name, serial number of pump, capacity in GPM and head in feet at design condition, horsepower, voltage, frequency, speed and full load current.

I. Control: Combination automatic timer kit with aquastat combination, pump runs only when timer is ON and water temperature is low enough to cause the aquastat to switch ON.

2.05 EXPANSION TANKS

A. Manufacturer: Amtrol, Bell and Gossett, Wessels.

B. Vertical steel precharged hydro-pneumatic expansion tank, 125 psi ASME labeled construction, complete with replaceable flexible butyl rubber bladder, system connection fitting, Schrader type air charge fitting, steel base ring stand, factory prime and enamel painted exterior finish, ASME relief valve. Materials exposed to water to be NSF or FDA approved for potable water service.

2.06 WATER SOFTENER

A. Manufacturer: Amtrol, Capital, Custom-Care, Hellenbrand, Water Right, Culligan, Total Water.

B. Tanks: Fiberglass reinforced mineral tank constructed of molded high density polyethylene inner shell reinforced by exterior fiberglass winding and epoxy resin. NSF approved and rated for 150 psig. Mount slotted or lateral hub PVC distributor in tank with underbedding gravel.

C. Mineral: High capacity ion exchange mineral, FDA approved, Sybron/Ionac, Rohm & Haas, Resintech or Puralite. Uniform beads rated for removal of 30,000 grains of hardness as calcium carbonate when regenerated with 15 lbs. of salt. Design for minimum 50% resin bed freeboard.
D. Valve: Top mount brass valve with motor drive, hydraulically balanced piston, seal and spacers, adjustable brine flow control, backwash flow control, adjustable capacity and regeneration settings. Provide bypass ball valve arrangement.
E. Controls: Factory wired and tested controls with transformer and labeled terminal block for twin alternating consisting of the following:
   1. Electronic Meter and 480 Microprocessor with LED Display for Immediate Regeneration.
F. Brine Tank: High density polyethylene brine tank with high salt platform, PVC brine measuring and float valve, PVC injector. Contractor to provide initial salt fill.
G. Ratings: Maximum 10 MG/L hardness leakage, 110° F maximum operating temperature, 30-100 psig operating pressure, 120/60/1 electrical.
H. Accessories:
   1. Flexible braided stainless steel pipe connectors for tanks over 24” in diameter.
   2. Inlet and outlet sampling valves, inlet and outlet pressure gauges with shutoff valve.
   3. Resin defoulant system with chemical metering pump, tubing and 4 month supply of chemical cleaner for iron and bacteria fouling.
I. Refer to schedules and details on plumbing drawings for additional information.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install plumbing equipment where indicated in accordance with manufacturer's recommendations. Coordinate equipment location with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. Locate equipment and arrange plumbing piping to provide access space for servicing all components.

B. Set commercial water heaters and commercial water softeners on concrete housekeeping pads. Adjust and level equipment.

C. Set sumps on compacted granular backfill adjusting for plumb and level. Backfill in even layers around sump with granular backfill.

D. Connect equipment to water and drain piping using unions or flanges and isolation valves.

E. Connect pneumatic controls to compressed air source.

F. Size temperature and relief valves per CSA ratings. Pipe temperature and pressure relief valves to floor drain or floor as indicated.
G. Venting of gas fired appliances shall be listed and labeled in accordance with UL 1738.

H. Startup and test equipment adjusting operating and safety controls for proper operation.

I. Lubricate pumps before startup. Adjust pumps for rated flow. Clean and blowdown strainers after 8 hours of operation.

J. Cycle softeners and adjust for specified exchange rate, regeneration time, consumption, backflow rate, etc. Provide initial salt fill of brine tank.

K. Adjust compression tank precharge to scheduled minimum operating pressure prior to connecting to system.

3.02 TRAINING

A. See Section 22 05 00 – Common Work Results for Plumbing for training requirements.

B. In addition to the training provided in Section 22 05 00 – Common Work Results for Plumbing, provide an additional 2 hours of training for each type of plumbing equipment provided on the project.

END OF SECTION

SECTION 22 42 00
COMMERCIAL PLUMBING FIXTURES

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Base Bid: Unless noted otherwise, the Plumbing Contractor shall provide all labor and materials for a complete system in this specification section.

1.02 SECTION INCLUDES

A. This section includes specifications for plumbing fixtures, faucets and trim.
   1. Plumbing Fixtures
      a. Drinking Fountains
      b. Electric Water Coolers
      c. Lavatories
      d. Mop Basins
      e. Sinks
      f. Water Closets
      g. Urinals

1.03 RELATED WORK

A. Applicable provisions of Division 1 shall govern work under this section.

B. Section 22 05 14 – Plumbing Specialties

C. Section 22 11 00 – Facility Water Distribution

D. Section 22 13 00 – Facility Sanitary Sewerage

1.04 SUBMITTALS

A. Refer to Section 22 05 00 – Common Work Results for Plumbing, Submittals. In addition to the general content specified under Section 22 05 00 – Common Work Results for Plumbing, supply the following submittals:
   1. Drinking Fountains
   2. Electric Water Coolers
   3. Lavatories
   4. Mop Basins
   5. Sinks
   6. Water Closets
   7. Urinals

B. Include data concerning sizes, rough in-dimensions, capacities, materials of construction, trim, finishes, manufacturer's installation requirements, manufacturer's performance limitations, and appropriate identification.

1.05 REFERENCE STANDARDS

A.	ANSI A112.6.1M	Supports for Off-the Floor Plumbing Fixtures for Public Use
B.	ANSI A112.18.1	Finished and Rough Brass Plumbing Fixture Fittings
C.	ANSI A112.19.1	Enameled Cast Iron Plumbing Fixtures
D.	ANSI A112.19.2M	Vitreous China Plumbing Fixtures
E.	ANSI A112.19.5	Trim for Water Closet Bowls, Tanks and Urinals
F.	ANSI Z124.2	Plastic Shower Receptors and Shower Stalls
G.	ARI-1010	Self-Contained Mechanically Refrigerated Drinking Water Coolers
H.	ASSE 1011	Hose Connection Vacuum Breakers

I. ASSE 1014 Handheld Showers

J. ASSE 1016 Individual Thermostatic, Pressure Balancing, and Combination Pressure Balancing and Thermostatic Control Valves for Individual Fixture Fittings

1.06 QUALITY ASSURANCE

A. Substitution of Materials: Refer to Division 1.

B. Plumbing products requiring approval by the State of Wisconsin Dept. of Safety & Professional Services must be approved or have pending approval at the time of shop drawing submission.

1.07 ENERGY EFFICIENCY REQUIREMENTS

A. Plumbing fixtures must meet the following maximum water usage requirements:
1. Lavatory Faucets, Public: flow of 0.5 gallons per minute, or 0.25 gallons per cycle
2. Sink Faucets: flow of 1.5 gallons per minute
3. Water Closet Flushometer Valves: 1.6 gallons per flush
4. Urinal Flushometer Valves: 0.5 gallons per flush

PART 2 – PRODUCTS

2.01 PLUMBING FIXTURES

A. Manufacturers: Fixture descriptions establish fixture type, quality, materials, features and size. Products of the following manufacturers determined to be equal by the Architect/Engineer will be accepted. Architect to select from manufacturer's standard finish colors.
1. Vitreous China and Enameled Cast Iron Fixtures: American Standard, Kohler, Sloan, Toto, Zurn
2. Water Closet Seats: Bemis, Beneke, Centoco, Olsonite Sperzel
3. Faucets: Chicago Faucet, American Standard, Sloan, Zurn
4. Stops and Supplies: Chicago Faucet, McGuire, Zurn
5. Flushometer Valves: Hydrotek, Delaney, Sloan, Zurn
6. Drains and Traps: Kohler, McGuire, Dearborn, Zurn
7. Carriers and Supports: Josam, J.R. Smith, Wade, Watts, Zurn
8. Electric Water Coolers: Elkay, Halsey Taylor, Haws, Oasis, Sunroc
9. Molded Stone Fixtures: Fiat, Mustee
10. Stainless Steel Sinks: American Standard, Elkay, Just, Kohler
11. Thermostatic Mixing Valves: Bradley, Lawler, Leonard, Powers

B. Drinking Fountains:
1. DF-1: Outdoor triple level drinking fountain, stainless steel construction in brown finish, with ADA height bowl and pet drinking bowl, push button activation, and recessed hose bibb with locking door. Provide mounting kit as required.
   a. Fixture: Willoughby WODF-3-HC-PET-HBLD-BR

C. Electric Water Coolers:
1. EWC-1: Wall mounted dual height barrier free electric water cooler, with electronic sensor operated bottle filling station, two stainless steel bowls self-closing push button activation, and water filter. Reversible bowl installation to meet ADA. Include floor mounted carrier. Chiller rated for 8 gph at 80 degree F inlet water, 90 degree ambient and 50 degree leaving water, 370 watts, 120/60/1. Light Gray panel finish.
   a. Fixture: Elkay LZSTL8WSLP
   b. Supply: 3/8" ball valve
   c. Trap: 1-1/2" x 1-1/2" PVC P-trap

D. Lavatories:

1. L-1: ADA compliant, wall-hung vitreous china lavatory in white finish, with 21¼" x 18 1/8" bowl with overflow, and single center faucet hole. With slow closing metering faucet, 0.5 gpm laminar spray outlet, and thermostatic mixing valve with checkstops and wall mounting bracket.
   a. Fixture: Kohler 'Kingston' K-2007-0
   b. Faucet: Zurn Z86100-XL
   c. TMV: Symmons Maxline 8210CK
   d. Carrier: Zurn Z1231 (Z1231-D at back-to-back lavatory installations)
   e. Drain: Kohler K-7129-A-CP strainer and 1¼" offset tailpiece
   f. Trap: McGuire 8902CNC 1¼" x 1½" 17 gauge cast brass p-trap
   g. Insulation Kit: See following 3.01 (E.) section for insulation kit information

2. L-2: ADA compliant, oval undermount vitreous china lavatory, 17" x 14", with overflow. With slow closing metering faucet, 0.5 gpm laminar spray outlet, and thermostatic mixing valve with checkstops and wall mounting bracket.
   a. Fixture: Kohler Caxton K-2209-0
   b. Faucet: Zurn Z86100-XL
   c. TMV: Symmons Maxline 8210CK
   d. Drain: Kohler K-7129-A-CP strainer and 1¼" offset tailpiece
   e. Trap: McGuire 8902CNC 1¼" x 1½" 17 gauge cast brass p-trap
   f. Insulation Kit: See following 3.01 (E.) section for insulation kit information

E. Mop Basins:
1. MB-1: Floor mounted fiberglass mop basin, 24" x 36" x 10", with 3" drain, stainless steel strainer, stainless steel wall guard (two wall guards for corner installation), 31" hose and hose holder, mop hanger, stainless steel bumper guards, faucet with integral stops, ceramic cartridges and lever handles, pail hook and wall brace, ASSE 1011 hose connection vacuum breaker.
   a. Fixture: Mustee 65M
   b. Wall Guards: Mustee 67.24C or 67.36C or 67.2436
   c. Hose and Holder: Mustee 65.700
   d. Mop Hanger: Mustee 65.600
   e. Bumper Guards: Mustee 65.404
   f. Faucet: Chicago Faucet 897-RCF
   g. Vacuum Breaker: Watts LF8AC

F. Sinks:
1. S-1: ADA compliant, counter mounted, 18 gauge type 304 stainless steel equal double compartment sink, 33" x 21-1/4" x 5½", with rear center 3½" drain opening, 3 centered faucet holes and basket strainer with offset tailpiece. Faucet with 8" rigid/swing gooseneck spout, ceramic disc cartridges, wrist blade handles, and 1.5 gpm flow control aerator.
   a. Fixture: Elkay LRAD332155
   b. Faucet: Chicago Faucet 201-G8AE35-317XKAB

c. Supplies: McGuire LFH2165LK
d. Drains (x2): Elkay LKAD35
e. Trap: 1½" x 1½" 17 gauge cast brass p-trap

2. S-2: ADA compliant, counter mounted, 18 gauge type 304 stainless steel single compartment sink, 19" x 18" x 5½", with rear center 3½" drain opening, 3 centered faucet holes and basket strainer with offset tailpiece. Faucet with 5 1/4" rigid/swing gooseneck spout, ceramic disc cartridges, wrist blade handles, and 1.5 gpm flow control aerator.
   a. Fixture: Elkay LRAD191855
   b. Faucet: Chicago Faucet 786-GN2FCXKABCP
   c. Supplies: McGuire LFH2165LK
   d. Drain: Elkay LKAD35
   e. Trap: 1½" x 1½" 17 gauge cast brass p-trap

3. S-3: ADA compliant, counter mounted, 18 gauge type 304 stainless steel single compartment sink, 19" x 18" x 5½", with rear center 3½" drain opening, 4 centered faucet holes and basket strainer with offset tailpiece. Faucet with 5 1/4" restricted swing gooseneck spout, ceramic disc cartridges, wrist blade handles, and 1.5 gpm flow control aerator. Furnish heavy-duty dishwasher air gap and install in fourth faucet hole.
   a. Fixture: Elkay LRAD191855
   b. Faucet: Chicago Faucet 786-GR2AE35V317AB
   c. Supplies: McGuire LFH2165LK
   d. Drain: Elkay LKAD35
   e. Trap: 1½" x 1½" 17 gauge cast brass p-trap
   f. DW Air Gap: Sioux Chief 249

4. S-4: ADA compliant, counter mounted, 18 gauge type 304 stainless steel equal double compartment sink, 33" x 21-1/4" x 5½", with rear center 3½" drain opening, 3 centered faucet holes and basket strainer with offset tailpiece. Faucet with 8" rigid/swing gooseneck spout, ceramic disc cartridges, wrist blade handles, and 1.5 gpm flow control aerator, and thermostatic mixing valve with checkstops and wall mounting bracket.
   a. Fixture: Elkay LRAD332155
   b. Faucet: Chicago Faucet 201-G8AE35-317XKAB
   c. TMV: Symmons Maxline 8210CK
   d. Supplies: McGuire LFH2165LK
   e. Drains (x2): Elkay LKAD35
   f. Trap: 1½" x 1½" 17 gauge cast brass p-trap

G. Water Closets:
1. WC-1: ADA height, floor mount, floor outlet white vitreous china high efficiency siphon jet water closet with elongated bowl, 1-1/2" top spud, 2-1/8" passageway, 16-5/8" rim height, antimicrobial finish. Manually operated dual-flush 1.1/1.6 gpf flushometer, with trip lever to wide-side of stall for accessible installations. White solid plastic commercial heavy duty open front seat with self-sustaining check hinges. Adjust flushometer outlet tube length as required to clear grab bars per Architectural detail.

a. Fixture: Kohler Highcliff Ultra K-96057-SS-0
b. Flushometer: Sloan WES 111 1.1/1.6
c. Seat: Bemis 2155SSCT

2. WC-2: Floor mount, floor outlet white vitreous china high efficiency siphon jet water closet with elongated bowl, 1-1/2" top spud, 2-1/8" passageway, 16-5/8" rim height, antimicrobial finish. Manually operated dual-flush 1.1/1.6 gpf flushometer, with trip lever to wide-side of stall for accessible installations. White solid plastic commercial heavy duty open front seat with self-sustaining check hinges.
   a. Fixture: Kohler Highcliff Ultra K-96057-SS-0
   b. Flushometer: Sloan WES 111 1.1/1.6
   c. Seat: Bemis 2155SSCT

3. WC-3: Children's height, floor mount, floor outlet white vitreous china high efficiency siphon jet water closet with elongated bowl, 1-1/2" top spud, 1-7/8" passageway, 10-1/2" rim height, antimicrobial finish. Manually operated dual-flush 1.1/1.6 gpf flushometer. Includes Kohler toilet seat with scalloped handholds. Adjust flushometer outlet tube length as required to clear grab bars per Architectural detail.
   a. Fixture: Kohler Primary K-96064-SS
   b. Flushometer: Sloan WES 111 1.1/1.6
   c. Seat: Kohler K-4686

H. Urinals:
1. U-1: Wall mounted white vitreous china high efficiency 0.5 gallon per flush washout urinal with 3/4" top inlet spud, 2" outlet, removable strainer, with floor mounted carrier. ADA mounting height with top of rim at 17" maximum above floor.
   a. Fixture: Kohler Bardon K-4991-ET
   b. Flushometer: Sloan Royal 186-0.5-H-CO
   c. Carrier: Zurn Z1218

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install plumbing fixtures in accordance with manufacturer's instructions. Set level and plumb. Secure in place to counters, floors and walls providing solid bearing and secure mounting. Bolt fixture carriers to floor and wall. Secure rough-in fixture piping to prevent movement of exposed piping.

B. Install each fixture with trap easily removable for servicing and cleaning. Install fixture stops in readily accessible location for servicing.

C. Install barrier free fixtures in compliance with the Wisconsin Administrative Code and Federal ADA Accessibility Guidelines.

D. Lavatory and sink p-traps may be installed with offset waste, with p-trap parallel and adjacent to wall. Supplies and stops are elevated to avoid contact by wheelchair users.

E. Install flexible white molded-vinyl or PVC fixture waste and supply piping protection for all sinks and lavatories with exposed piping, Zurn Z8946-NT, TrueBro LavGuard2, or equal.

F. Install two-station electric water coolers per manufacturer and ADA guidelines, including bubbler orifice of lower unit not to exceed 36" above finished floor, with cane apron where required. Provide unions at water connections to electric water coolers. Confirm with Architectural elevations.

G. Where individual toilet rooms contain one or more wall mounted urinals, install one urinal with the lip 17” above finished floor. Install all additional urinals within the same room with the lip 24” above finished floor. Verify mounting heights with Architectural elevations.

H. Verify with Architectural elevations that water closet flushometer does not conflict with back-wall mounted grab bar.

I. Water closet trip lever to be installed on wide side of accessible stall.

J. Each fixture shall have a stop valve installation to control the fixture. Stop valves shall be heavy duty type with brass stems and screwed or sweat inlet connections. Compression type inlets are not acceptable.

K. Cover pipe wall penetrations with escutcheons. Exposed traps, stops, piping and escutcheons to be chrome plated brass, unless otherwise indicated.

L. Set floor mounted plumbing fixtures, counter mounted sinks, lavatory and sink faucets and drains with full setting bed of flexible non-staining plumber's putty.

M. Seal wall mounted plumbing fixtures to wall with silicone sealant. Seal mop basins to floor and wall with grout or silicone sealant.

N. Seal openings between walls, floors and fixtures with mildew-resistant silicone sealant same color as fixture.

O. Adjust lavatory mixing valve outlet water temperature limit stops to maximum 110°F.

P. Test fixtures to demonstrate proper operation. Replace malfunctioning units or components. Adjust flush valves for intended water flow rate to fixtures without splashing, noise or overflow. Adjust self-closing faucets to 15 second cycle.

Q. Protect fixtures during construction. At completion clean plumbing fixtures and trim using manufacturer's recommended cleaning methods and materials.

END OF SECTION

SECTION 23 05 00
COMMON WORK RESULTS FOR HVAC

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. It is the intent of these specifications to provide complete and workable mechanical systems as shown on the accompanying plans and as specified herein except such parts as are specifically exempted herein. Provide all necessary supervision, coordination, labor, materials, equipment, fixtures, dryage, hoisting, tools, transportation, plant services and facilities, machinery and connections to utilities for the installation of complete and operable mechanical systems. If details or special conditions are required in addition to those shown on drawings, provide all material and equipment usually furnished with such systems or required to complete their installation, whether noted in plans and specification or not.

B. Materials and labor shall be new (unless noted otherwise), first class and workmanlike and shall be subject at all times to the A/E's inspections, tests and approval from the commencement until the acceptance of the completed work.

C. The layout shown on the drawings is necessarily diagrammatic but shall be followed as closely as other work will permit. The drawings provide design intent. The Contractor shall verify all dimensions at the site and be responsible for their accuracy.

D. Because of the scale of the Drawings, certain basic items, such as, pipe fittings, duct fittings, access panels, and sleeves, may not be shown. Where such items are required by Code or by other Sections, or where required for proper installation of the Work, such items shall be included, whether shown or not.

E. In the event of any inconsistencies between the specifications, drawings, contract documents, applicable laws, statutes, ordinances, building codes, rules and regulations, the contractor shall provide the better quality or greater quantity of work and comply with or conform its work to the most stringent legal or contractual requirements.

F. Changes from these drawings required to make this work conform to the building construction shall be made only with prior written approval of the Architect/Engineer. All proposed changes shall be shown on shop drawings. All measurements shall be verified by actual observation and all work shall fit in place meeting the approval of the Architect/Engineer.

G. Equipment Specification may not deal individually with minute items required, such as, components, parts, controls, and devices which may be required to produce the equipment performance specified or as required to meet the equipment warranties. Where such items are required to make the system operational, they shall be included by the supplier of the equipment at no additional cost, whether or not specifically called for.

1.02 SECTION INCLUDES

A. This section includes information common to two or more technical specification sections or items that are of a general nature, not conveniently fitting into other technical sections.
   1. Submittals
   2. Reference Standards
   3. Quality Assurance
   4. Guarantee
   5. Operation and Maintenance Instructions
   6. Record Documents
   7. Continuity of Existing Services
   8. Protection of Finished Surfaces
   9. Sealing and Firestopping
   10. Off Site Storage
   11. Regulatory Requirements
   12. Certificates and Inspections
   13. Coordination

14. Demolition and Existing Requirements
15. Request and Certification for Payment
16. Sleeves And Openings
17. Omissions
18. Definitions
19. Project/Site Conditions
20. Work Sequence and Scheduling
21. Salvage Materials
22. Training
23. Access Panels and Doors
24. Identification
25. Demolition
26. Excavation and Backfill
27. Concrete Work
28. Cutting and Patching
29. Lintels
30. Building Access
31. Equipment Access
32. Lubrication
33. Housekeeping and Clean Up

1.03 RELATED WORK

A. Applicable provisions of Division 1 govern work under this section.
B. This section applies to all Division 23 sections.
C. Division 31 – Earthwork

1.04 SUBMITTALS

A. Submit shop drawings for equipment under each section per requirements listed in that section, as well as per Division 1.
B. Submit for all equipment and systems as indicated in the respective specification sections, marking each submittal with that specification section number. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in the contract documents. Failure to do this may result in the submittal(s) being returned to the Contractor for correction and resubmission. Do not submit hard copies of web pages. Failing to follow these instructions does not relieve the Contractor from the requirement of meeting the project schedule.
C. On request from the A/E, the successful bidder shall furnish additional drawings, illustrations, catalog data, performance characteristics, etc.
D. Submittals shall be grouped to include complete submittals of related systems, products, and accessories in a single submittal. Mark dimensions and values in units to match those specified. Include wiring diagrams of electrically powered equipment.
E. The submittals must be approved before fabrication is authorized.
F. Provide electronic copies of all submittals for review.
G. Before submitting electrically powered equipment, verify that the electrical power and control requirements for the equipment are in agreement with the motor starter schedule on the electrical drawings. Include a statement on the shop drawing transmittal to the architect/engineer that the equipment submitted and the motor starter schedule is in agreement or indicate any discrepancies. See related comments in Section 23 05 13 in Part 1 under Electrical Coordination.

1.05 REFERENCE STANDARDS

A. Abbreviations of standards organizations referenced in other sections are as follows:
   1. AABC Associated Air Balance Council
   2. ABMA American Boiler Manufacturers Association
   3. ADC Air Diffusion Council
   4. AGA American Gas Association

5. AMCA Air Movement and Control Association
6. ANSI American National Standards Institute
7. AHRI Air-Conditioning, Heating and Refrigeration Institute
8. ASHRAE American Society of Heating, Refrigerating and Air Conditioning Engineers
9. ASME American Society of Mechanical Engineers
10. ASTM American Society for Testing and Materials
11. AWWA American Water Works Association
12. AWS American Welding Society
13. EPA Environmental Protection Agency
14. ETL Edison Testing Laboratories
15. FM Factory Mutual Insurance Company
16. GAMA Gas Appliance Manufacturers Association
17. HI Hydraulic Institute
18. ICC International Code Council
19. IEEE Institute of Electrical and Electronics Engineers
20. IRI Industrial Risk Insurers
21. ISA Instrument Society of America
22. ISO International Organization for Standardization
23. MCAA Mechanical Contractors Association of America
24. MICA Midwest Insulation Contractors Association
25. MSS Manufacturer's Standardization Society of the Valve & Fitting Industry, Inc.
26. NBS National Bureau of Standards
27. NEBB National Environmental Balancing Bureau
28. NEC National Electric Code
29. NEMA National Electrical Manufacturers Association
30. NFPA National Fire Protection Association
31. OSHA Occupational Safety and Health Administration
32. SMACNA Sheet Metal and Air Conditioning Contractors' National Association. Inc.
33. TABB Testing, Adjusting and Balancing Bureau
34. UL Underwriters Laboratories Inc.
35. ASTM E814 Standard Test Method for Fire Tests of Through-Penetration Fire Stops
36. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials
37. UL1479 Fire Tests of Through-Penetration Firestops
38. UL723 Surface Burning Characteristics of Building Materials

1.06 QUALITY ASSURANCE

A. Substitution of Materials: Refer to Division 1 for equals and substitutions.
   1. Where the following conflicts with Division 1, the requirements of Division 1 shall govern.
   2. If the Contractor wishes to submit an alternate to the named manufacturers for any equipment, he may submit a voluntary alternative minimum 7 days prior to bid, stating the manufacturer's name, model number, written, detailed product data.
   3. Where materials or equipment are specified by name the proposed material or equipment must be identical to the specified material or equipment in all characteristics of quality, function and serviceability, regardless of application in the Project and, in addition, when the Architect deems that aesthetic significance is important, the equal material or equipment must be identical in all characteristics of visual appearance, design, color and texture. Any proposed equal shall be submitted to Architect/Engineer for prior approval, which Architect/Engineer may approve or disapprove in its sole discretion. Work performed or constructed with unapproved equals is at Contractor's risk and any required correction of work incorporating unapproved equals shall be at Contractor's sole cost and expense.
   4. In all instances, Contractor shall assume full responsibility for proof of equality of the statute to the equipment hereinafter specified. All data and information necessary for proof of equality, function and space requirements shall be prepared and accompany the submittal of the substitution to the Architect/Engineer. Approval by the Architect/Engineer of equipment other than the specified does NOT relieve Contractor of this responsibility.

B. All products and materials used are to be new, undamaged, clean and in good condition. Existing products and materials are not to be reused unless specifically indicated.
C. Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings, or engineering parameters from those indicated on the contract documents, the contractor is responsible for all costs involved in integrating the equipment/electrical or accessories into the system, including but not limited to, coordination with other trades and any required changes by other trades and for obtaining the performance from the system into which these items are placed. This may include changes found necessary during the testing, adjusting, and balancing phase of the project.

1.07 GUARANTEE

A. Refer to Division 1 for Guarantees and Warranties. In addition to the requirements in Division 1, this Contractor shall meet the following requirements.
B. In entering into a contract covering this work, the contractor accepts the specifications and guarantees that the work will be carried out in accordance with the requirements of this specification or such modifications as may be made under the contract documents.
C. Contractor further guarantees that the workmanship and material will be of the best procurable and that none but experienced workmen familiar with each particular class of work will be employed.
D. Contractor further guarantees to replace and make good at his own expense, including travel time, all defects, which may develop within 1 year after final payment and acceptance by the Architect/Engineer, due to faulty workmanship or material, upon, receipt of written notification from the Owner.

1.08 OPERATION AND MAINTENANCE INSTRUCTIONS

A. Refer to Division 1 for all operations and maintenance instructions.
B. In addition to the general content specified under Division 1 supply the following additional documentation:
   1. Copies of all approved shop drawings along with approval letters.
   2. Manufacturer's wiring diagrams for electrically powered equipment
   3. Records of tests performed to certify compliance with system requirements
   4. Certificates of inspection by regulatory agencies
   5. Temperature control record drawings and control sequences
   6. Parts lists for manufactured equipment
   7. Valve schedules
   8. Lubrication instructions, including list/frequency of lubrication done during construction
   9. Warranties
   10. Additional information as indicated in the technical specification sections

1.09 RECORD DOCUMENTS

A. Refer to Division 1 for record documents.
B. In addition to the general content specified under Division 1, follow the following procedures.
   1. During the progress of the work, Contractor shall maintain a current (daily) record set of the drawings and specifications, indicating thereon all work installed at variance with such Contract Documents including, without limitation, work covered by Addenda, Field Work Orders, Change Orders and Engineers additional instructions, interpretations and clarification. All changes or deviations from the original layout of the work and all critical dimensions of buried or concealed work shall be recorded. It shall be Contractor's responsibility to assure that said record sets are complete, accurate and up-to-date, Engineer shall have the right to inspect and review such record sets.
   2. At the completion of the work, Contractor shall indicated on record sets all record changes and such additional details necessary or appropriate to provide a complete reference document for use by Engineer. If variations and details cannot be shown clearly thereon, the Contractor shall prepare supplemental drawings adequate to impart the information. The foregoing drawings collectively shall constitute the "Record" drawings for the work.

3. All indication on “Record” drawings shall be executed in a legible manner at Contractor’s cost, using methods and legend presentations compatible with the overall scheme of the record drawings with respect to scale, drawing sheet sizes and sequential indexing. All changes shall be marked clearly in red and clouded.
4. Engineer may review Contractor’s “Record” drawings and notify Contractor of observed discrepancies or deviations. Contractor shall promptly correct discrepancies, deviations or illegible markups at Contractor’s expense and resubmit revised drawings for Engineer review.
5. Engineer will provide final electronic record drawings to Owner based on Contractor’s markups.

C. In addition to the data indicated in the Division 1, maintain temperature control record drawings on originals prepared by the installing contractor/subcontractor. Include copies of these record drawings with the Operating and Maintenance manuals.

1.10 CONTINUITY OF EXISTING SERVICES

A. Do not interrupt or change existing services without prior written approval from the Owner's Project Representative. When interruption is required, coordinate scheduling of down-time with the Owner to minimize disruption to his activities. Unless specifically stated, all work involved in interrupting or changing existing services is to be done during normal working hours.

B. Each Contractor shall thoroughly familiarize themselves with existing systems which will affect and be affected by relocation of existing equipment and installation of new lines and equipment. They shall plan installation of their work so that interruptions of services to any building or portion thereof will be a minimum and such interruptions shall occur only when system is not required, if possible. If not possible, each Contractor shall insure the operation of services by whatever means possible, such as, installing bypasses, capping of services or providing temporary service. Each interruption shall be for as short a duration as possible.

1.11 PROTECTION OF FINISHED SURFACES

A. Refer to Division 1 for protection of finished surfaces.

B. Furnish one aerosol spray can of touch-up paint for each different color factory finish which is to be the final finished surface of the product. Deliver touch-up paint with other "loose and detachable parts" per Division 1.

1.12 SEALING AND FIRESTOPPING

A. Sealing, fireproofing patching, fire caulking and firestopping of sleeves/openings between ductwork, piping, etc. and the sleeve, structural or partition opening shall be the responsibility of the contractor whose work penetrates the opening. The contractor responsible shall hire individuals skilled in such work to do the sealing and fireproofing. These individuals hired shall normally and routinely be employed in the sealing and fireproofing occupation.

B. Contractor shall request current life safety drawings from Architect/Owner.

1.13 OFF SITE STORAGE

A. If payment will be requested for approved offsite stored material, then the Contractor shall complete an "Off-site Storage Agreement" which is available from the Owner. Prior approval by Owner’s personnel for offsite storage will be needed. No material will be accepted for offsite storage unless submittals for the material have been approved.

1.14 REGULATORY REQUIREMENTS

A. Comply with requirements of Wisconsin Administrative Code and local Authority Having Jurisdiction (AHJ) regarding materials and installation.

1.15 CERTIFICATES AND INSPECTIONS

A. Refer to Division 1 for permits, regulations, utilities and taxes.

B. Obtain and pay for all required State or local installation inspections except those provided by the Architect/Engineer in accordance with State Code. Deliver originals of these certificates to the Owner. Include copies of the certificates in the Operating and Maintenance Instructions.

C. Coordinate and provide inspections as required by the Authority Having Jurisdiction over the site.

D. Where applications are required for procuring services to the Building, prepare and file such application with the utility company. Furnish all information required in connection with the application in the form required by the utility company.

1.16 COORDINATION

A. Refer to Division 1 for coordination. In addition to the requirements specified under Division 1, the following requirements apply.
B. It shall be the responsibility of each Contractor to coordinate and consult with each other to determine space requirements and to determine that adequate space for servicing is provided for all equipment whether furnished by the Contractor or others. The General Contractor shall have final decision on all space priority conflicts among Contractors. All space priority conflicts shall be brought to the attention of the Architect/Engineer and Owner's Representative.
C. Each Contractor shall thoroughly familiarize themselves with existing systems which will affect and be affected by relocation of existing equipment and installation of new lines and equipment. They shall plan installation of their work so interruptions of services to any building or portion thereof will be a minimum, and such interruptions shall occur only when system is not required, if possible. If not possible, each Contractor shall insure operation of services by whatever means possible, such as, installing bypasses, capping of services, or providing temporary service. Each interruption shall be for as short a duration as possible.
D. Cooperation among all Contractors shall be required. Any Work that is installed without cooperating or coordinating with other Contractors and is in conflict shall be removed and reinstalled at that particular Contractor's cost. No cost additions to the Project will be considered due to a Contractor's lack of participation in the cooperation and coordination process. The following list of items of Work shall be the priority of order for all Contractors:
   1. Structure
   2. Recessed light fixtures
   3. Gravity-flow systems for sanitary, storm, steam and steam condensate piping
   4. Ductwork and appurtenances
   5. Electrical and low voltage cable tray
   6. Plumbing vent piping
   7. Fire protection (sprinkler system)
   8. HVAC piping
   9. Gas piping, process piping and domestic water
   10. Electrical conduit and low voltage conduit
   11. Control conduit
E. The above list, in descending order, is the precedence assigned the Work items for space priority. Gravity-flow systems have first priority.
F. Exception: Plumbing lines below or behind plumbing fixtures shall have precedence over all other work. Electrical conduit above or below switchgear, panelboards and control panels shall have precedence over all other work. Do not install any fluid conveying piping over electrical or elevator equipment.
G. In the case of interconnection of the work of two or more contractors, verify at the site or on shop drawings all dimensions relating to such work. All errors due to the failure to so verify any such dimensions shall be promptly rectified.
H. Any installed work that is not coordinated and interferes with another contractor’s work shall be removed or relocated at the installing contractor’s expense.
I. Prior to start of Construction, the General Contractor shall schedule a meeting with all of the Contractors responsible for the work items listed above. The purpose of the meeting is to introduce the coordination program and to determine its implementation in relation to the progress schedule.
J. At initial Coordination Meeting, Mechanical Contractor/Ventilating Contractor shall provide to General Contractor, outline drawings at 1/4" scale indicating column centerlines, interior partition locations, and ceiling heights. General Contractor shall verify information shown on these drawings and relay any changes in the information to Ventilation Contractor to be reflected on the Drawings. Ventilating Contractor, with reference and consideration to Structural, Heating, Electrical, Fire Protection, and Plumbing Drawings, shall draw to scale his proposed installation showing duct sizes, equipment layouts, and dimensions from column lines and from finished floors to bottom of ducts.

Ductwork shall be maintained as tightly as possible to underside of floor slabs and/or beams. For congested areas Ventilating Contractor shall, in addition, prepare Drawings in section view. During this phase of the program, it shall be Electrical Contractor's responsibility to furnish Ventilating Contractor with recessed lighting installation and clearance requirements. This information shall be outlined on Drawings by Ventilating Contractor.

K. The ductwork layouts shall be produced in sequence as mandated by the Project Schedule. The earliest area indicated in the Schedule shall receive the first effort, etc.

L. When the Ductwork Drawings for the earliest scheduled area have been completed (time limitation as determined at the initial coordination meeting), the Ventilating Contractor shall provide the General Contractor with one set of drawings for each participant in the effort. The General Contractor will distribute the drawings to the participating Contractors for their use in drawing thereon the major components of their proposed installation using the general scheme shown on the Contract Drawings as a guide.

M. The major components to be indicated include (but are not limited to) the following:
   1. Structure
   2. Roof drain leaders
   3. Above 3" waste piping
   4. Sprinkler mains
   5. Heating hot water mains
   6. Chilled water mains
   7. Conveying systems
   8. Significant conduit runs
   9. Cable trays
   10. Contract ceiling heights
   11. Soffits
   12. Access points
   13. Fire wall penetrations
   14. Gas, water, and process piping

N. Information delineated shall be distance from column centerlines, pipe/equipment size, and distance from finished floor to bottom of pipe/equipment and hangers. Included on the Drawings shall be piping layout with hanger locations and hanger point loads. This information shall be developed satisfactorily enough to allow the Structural Engineer to verify the adequacy of the structural system for the projected loads. The hanger locations may have to be moved depending on the structural system review. No hanger shall be fabricated and/or installed until the hanger locations are reviewed and accepted by the Architect/Engineer.

O. Within a period not to exceed two weeks after distribution of the drawings, the General Contractor will schedule a meeting with the Architect/Engineer and participating Contractors at which time areas of conflict shall be resolved. The drawings shall be overlaid to identify areas of conflict. All parties shall then cooperate in resolving the conflicts. Records of the agreements shall be entered on the Ventilating Contractor's drawings, acknowledged by all participants by signature in space provided for this purpose, and two copies distributed to all involved parties. All coordination drawing preparation and reproduction costs shall be borne by the Ventilating Contractor. The above drawings, review, and coordination process shall be repeated until all areas on the Project have been coordinated.

P. In the event a Contractor fails to cooperate in the Coordination Program, they shall be held responsible for all costs incurred for adjustments to the work of others made necessary to accommodate the uncooperative Contractor's installations.

1.17 DEMOLITION AND EXISTING REQUIREMENTS

A. Existing active services: water, gas, medical gas, steam, ventilation, compressed or control air, sanitary waste, sanitary vent, storm electric, and any other building systems when encountered shall be protected against damage. Where existing services are to be abandoned, the services shall be removed back to the point of origin and removed from the site unless otherwise directed by the Owner's Representative.

B. Submit a "Sequence of Work Schedule" in respect to all temporary and permanent utility and service cutovers after final determination. This schedule shall be submitted for approval to the Owner and Architect/Engineer. The submittal shall designate priority order, service or utility affected, date of cutover, and time of day to start and finish.
C. Bidders should inspect the site to become familiar with conditions of the site which will affect the Work. Bidders should verify points of connection with utilities, routing of outside piping to include required clearances from any existing structures, or other obstacles.
D. Extra payment will not be allowed for changes in the Work required because of the successful bidder's failure to make this inspection.

1.18 REQUEST AND CERTIFICATION FOR PAYMENT

A. Within 10 days after Notice to Proceed, the successful bidder will submit to the Owner's Project Representative in a form prescribed by Division 1, a cost breakdown of the proposed values for work performed which, if approved by the owner, will become the basis for construction progress and monthly payments. The cost breakdown items shall reflect actual work progress stages as closely as feasible.
B. In addition, if payment is requested for approved off-site stored material, then that material shall be listed as a line item in the request and certification for payment cost breakdown.

1.19 SLEEVES AND OPENINGS

A. Openings required in new or existing construction that may be necessary for the installation of new work shall be provided by the respective contractor and all patching and repairing shall be done by workmen competent in the trade required, at the expense of the respective contractor. The respective contractor shall be responsible for arranging the work so that minimum cutting will be required. All rubbish and excess materials involved in such cutting shall be promptly removed from the site and disposed of by the contractor. Cutting through the floor or roof systems or load bearing walls shall be done only with the prior written approval of the Architect/Engineer so as to avoid damaging the structural system.

1.20 OMISSIONS

A. No later than ten (10) days before bid opening, the Contractor shall call the attention of the A/E to any materials or apparatus the Contractor believes to be inadequate and to any necessary items of work omitted.

1.21 DEFINITIONS

A. The term "provide" includes such labor, methods, materials, equipment and transportation or other facilities required to complete the Contract and the performance of all duties thereby upon the Contractor.

1.22 PROJECT/SITE CONDITIONS

A. Install Work in locations shown on Drawings, unless prevented by Project conditions.
B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of A/E before proceeding.
C. Tools, materials and equipment shall be confined to areas designated by the Owner's project representative.

1.23 WORK SEQUENCE AND SCHEDULING

A. Install work in phases to accommodate Owner's occupancy requirements. During the construction period coordinate schedule and operations with Owner's Construction Representatives.

1.24 SALVAGE MATERIALS

A. No materials removed from this project shall be reused (except as specifically noted below). All materials removed shall become the property of and shall be disposed of by the Contractor.

1.25 TRAINING

A. The contractor shall have the following responsibilities:

1. Provide a training plan sixty days before the planned training covering the following elements:
   a. Equipment
   b. Intended audience
   c. Location of training
   d. Objectives
   e. Subjects covered (description, duration of discussion, special methods, etc.)
   f. Duration of training on each subject
   g. Instructor for each subject
   h. Methods (classroom lecture, manufacturer's quality video, site walk-through, actual operational demonstrations, written handouts, etc.).
2. Provide designated owner personnel with comprehensive orientation and training in the understanding of the systems and the operation and maintenance of each piece of equipment that makes up the system.
3. Training shall normally start with classroom sessions followed by hands-on demonstration/training on each piece of equipment.
4. During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system shall be repaired or adjusted as necessary and the demonstration repeated at another scheduled time, if necessary.
5. The appropriate trade or manufacturer's representative shall provide the instructions on each major piece of equipment. Practical building operating expertise as well as in-depth knowledge of all modes of operation of the specific piece of equipment are required. More than one party may be required to execute the training.
6. The controls contractor shall attend sessions other than the controls training, as specified, to discuss the interaction of the controls system as it relates to the equipment being discussed.
7. The training sessions shall follow the outline in the table of contents of the operation and maintenance manual and illustrate whenever possible the use of the O&M manuals for reference.
8. Training shall include:
   a. Use of the printed installation, operation and maintenance instruction material included in the O&M manuals.
   b. A review of the written O&M instructions emphasizing safe and proper operating requirements, preventative maintenance, special tools needed and spare parts inventory suggestions. The training shall include startup, operation in all modes possible, shutdown, seasonal changeover and any emergency procedures.
   c. Discussion of relevant health and safety issues and concerns.
   d. Discussion of warranties and guarantees.
   e. Common troubleshooting problems and solutions.
   f. Explanatory information included in the O&M manuals.
   g. Discussion of any peculiarities of equipment installation or operation.
   h. Classroom sessions shall include the use of overhead projections, slides, video/audio-taped material as might be appropriate.
   i. Hands-on training shall include startup, operation in all modes possible, including manual, shut-down, alarms, power failure and any emergency procedures, and preventative maintenance for all pieces of equipment.
9. The contractor shall fully explain and demonstrate the operation, function and overrides of any local packaged controls not controlled by the central control system.

B. Video recording of the training sessions will be provided by the contractor and added to the O&M manuals. In addition, factory training videos identifying key troubleshooting, repair, service and/or replacement techniques shall be provided and reviewed with the owner.
C. Provide a minimum of **16 hours** of instruction.
D. Provide additional training as specified in other specification sections for specific equipment.

PART 2 - PRODUCTS

2.01 ACCESS PANELS AND DOORS

A. Lay-In Ceilings:

1. Removable lay-in ceiling tiles in 2 X 2 foot or 2 X 4 foot configuration provided under Division 9 are sufficient; no additional access provisions are required unless specifically indicated.

B. Plaster Walls and Ceilings:
1. 16 gauge frame with not less than a 20 gauge hinged door panel, prime coated steel for general applications, stainless steel for use in toilets, showers, and similar wet areas, concealed hinges, screwdriver operated cam latch for general applications, key lock for use in public areas, UL listed for use in fire rated partitions if required by the application. Use the largest size access opening possible, consistent with the space and the equipment needing service; minimum size is 12" by 12".

2.02 IDENTIFICATION

A. Piping and ductwork labels shall follow owner's labeling and naming standards.
B. Stencils:
1. Not less than 1 inch high letters/numbers for marking pipe and equipment.
C. Snap-On Pipe Markers:
1. Cylindrical self-coiling plastic sheet that snaps over piping insulation and is held tightly in place without the use of adhesive, tape or straps. Not less than 1 inch high letters/numbers and flow direction arrows for piping marking. W. H. Brady, Seton, Marking Services.
D. Engraved Name Plates:
1. White letters on a black background, 1/16 inch thick plastic laminate, beveled edges, screw mounting, Setonply Style 2060 by Seton Name Plate Company or Emedolite- Style EIP by EMED Co., or equal by Marking Services, or W. H. Brady.
E. Valve Tags:
1. Round brass tags with 1/2 inch numbers, 1/4 inch system identification abbreviation, 1-1/4 inch minimum diameter, with brass jack chains or brass "S" hooks around the valve stem, available from EMED Co., Seton Name Plate Company, Marking Services, or W. H. Brady.

2.03 SLEEVES AND OPENINGS

A. General:
1. Pipe sleeves shall be constructed of standard weight ASTM A53 or ASME B36.10 steel with an anchor plate constructed of A36/A36M steel welded to the pipe. The sleeve shall be sized a minimum of 1" larger than piping insulation diameter. The entire assembly shall be hot-dip galvanized after fabrication.
2. Duct sleeves and piping sleeves passing through interior walls shall be constructed of 24 gauge galvanized steel minimum thickness.
B. Sleeves Through Below Grade Walls:
1. Provide steel pipe sleeve, ASTM A53, pressure sealing with membrane clamp ring, gasket, water stop ring, external rings, and nitrile rubber link seals. The assembly shall be hot-dip galvanized after fabrication.
   a. Seals: Modular mechanical type seals, consisting of interlocking nitrile rubber links shaped to continuously fill the annular space between the pipe and the sleeve and electrically isolate the carrier pipe from the steel sleeve.
   b. Sealing Element: Polychloroprene rubber material compounded to resist aging, ozone, sunlight, hydrocarbon gases, water, and chemical action.
   c. Hardware: Type 300 series stainless steel fasteners. Threads rolled to produce smooth uniform threads and unbroken flow lines.
   d. Compression Plates: Fiberglass-reinforced polyester plastic, injection molded for high physical properties, dielectric strength and non-cold flow creep characteristics, having high resistance to acidic and alkaline soils.
2. For sleeves located 15 feet or more below grade provide cast iron sleeve ASTM A74 with compression seals.

2.04 SEALING AND FIRESTOPPING

A. Fire and/or Smoke Rated Penetrations:
1. Manufacturers: 3M, Hilti, Rectorseal, STI/SpecSeal, Tremco.
2. All firestopping systems shall be provided by the same manufacturer.

3. Submittals: Contractor shall submit product data for each firestop system. Submittals shall include product characteristics, performance and limitation criteria, test data, MSDS sheets, installation details and procedures for each method of installation applicable to this project. For non-standard conditions where no UL tested system exists, submit manufacturer's drawings for UL system with known performance for which an engineering judgment can be based upon.
4. Product:
   a. Fire stop systems shall be UL listed or tested by an independent testing laboratory approved by the Owner and the Authority Having Jurisdiction (AHJ).
   b. Use a product that has a rating not less than the rating of the wall or floor being penetrated. Reference architectural drawings for identification of fire and/or smoke rated walls and floors.
   c. Contractor shall use firestop putty, caulk sealant, intumescent wrap strips, intumescent firestop collars, firestop blocks, firestop mortar or a combination of these products to provide a UL listed system for each application required for this project. Provide mineral wool backing where specified in manufacturer's application detail.
   d. All sealants shall meet the intent of LEED® VOC requirements, <250 g/L VOC contents (less H_20 and exempt solvents).

B. Non-Rated Penetrations:
1. Pipe Penetrations Through Below Grade Walls: In exterior wall openings below grade, use a modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the uninsulated pipe and the cored opening or a water-stop type wall sleeve. The operating bolts of the mechanical type seal shall be accessible from the building interior.
2. Pipe Penetrations: At pipe penetrations of non-rated interior partitions, floors and exterior walls above grade, use urethane caulk in annular space between pipe insulation and sleeve. For non-rated drywall, plaster or wood partitions where sleeve is not required use urethane caulk in annular space between pipe insulation and wall material.
3. Duct Penetrations:
   a. Annular space between duct (with or without insulation) and the non-rated partition or floor opening shall not be larger than 2". Where existing openings have an annular space larger than 2", the space shall be patched to match existing construction to within 2" around the duct.
   b. Where shown or specified, pack annular space with fiberglass batt insulation or mineral wool insulation. Provide 4" sheet metal escutcheon around duct on both sides of partition or floor to cover annular space.

PART 3 – EXECUTION

3.01 DEMOLITION

A. If any contractor's work requires the removal and replacement of any finished materials including but not limited to such materials as ceiling tiles, wall finishes, cabinets, doors, flooring, windows, etc. after those items are installed, each contractor will be responsible, at no additional cost to the owner, to replace any damaged, soiled or lost materials with new materials to match the existing materials and those materials damaged.

3.02 EXCAVATION AND BACKFILL

A. Perform all excavation and backfill work to accomplish indicated mechanical systems installation in accordance with Division 31. Blasting will not be allowed without written permission of the Architect/Engineer and the owner.
B. Install lines passing under foundations with minimum of 1-1/2 inch clearance to concrete and insure there is no disturbance of bearing soil.

3.03 CONCRETE WORK

A. All cast-in-place concrete will be performed by the Division 3 Contractor unless otherwise noted. Provide all layout drawings, anchor bolts, metal shapes, and/or templates required to be cast into concrete or used to form concrete for support of mechanical equipment.

3.04 CUTTING AND PATCHING

A. Refer to Division 1 for cutting and patching. In addition to the requirements in Division 1:
B. Each Contractor shall coordinate the placing of openings in the new structure as required for the installation of each Contractor's work.
C. Each Contractor shall furnish to the General Contractor the accurate locations and sizes for required openings in the new work, but this shall not relieve each Contractor of the responsibility of checking to assure that properly sized openings are provided. When additional patching is required due to the Contractor's failure to inspect this work, then the Contractor shall make arrangements for the patching required to properly close the openings to include patch painting, and the Contractor shall pay any additional cost incurred in this respect.
D. If cutting and patching of the new structure is made necessary due to the Contractor's failure to install piping, ducts, sleeves, or equipment on schedule, or due to the Contractor's failure to furnish on schedule the information required for the leaving of openings, then it shall be the Contractor's responsibility to make arrangements and obtain approval from the General Contractor and Architect/Engineer for this cutting and patching, and the Contractor shall pay any additional cost incurred in this respect. The Contractor shall also reimburse the Owner for any additional costs incurred to the Architect/Engineer for additional services caused by the Contractor in this respect.
E. The Contractor shall provide cutting and patching and patch painting in the existing structure as required for the installation of his Work and shall furnish lintels and supports as required for openings. Cutting of structural support members will not be permitted without prior approval of the Architect/Engineer. Extent of cutting shall be minimized; use core drills, power saws, or other machines which will provide neat, minimum openings. Patching shall match adjacent materials and surfaces and shall be performed by craftsmen skilled in the respective craft required.

3.05 LINTELS

A. All steel lintels required for opening in existing and/or new masonry walls shall be provided under Division 5 – Metal Fabrications. This contractor shall design, fabricate, and install all lintels required in masonry walls for duct and pipe penetrations. Contractor shall submit design drawings of lintels with professional engineers seal and signature prior to installation.

3.06 BUILDING ACCESS

A. Arrange for the necessary openings in the building to allow for admittance of all apparatus. When the building access was not previously arranged and must be provided by this contractor, restore any opening to its original condition after the apparatus has been brought into the building.

3.07 EQUIPMENT ACCESS

A. Install all piping, conduit, ductwork, and accessories to permit access to equipment for maintenance and service. Coordinate the exact location of wall and ceiling access panels and doors with the General Contractor, making sure that access is available for all equipment and specialties. Access doors in general construction are to be furnished by the Mechanical Contractor and installed by the General Contractor.
B. Provide color coded thumb tacks or screws, depending on the surface, for use in accessible ceilings which do not require access panels.

3.08 COORDINATION

A. Verify that all devices are compatible for the surfaces on which they will be used. This includes, but is not limited to, diffusers, register, grilles, and recessed or semi-recessed heating and/or cooling terminal units installed in/on architectural surfaces.
B. Coordinate all work with other contractors prior to installation. Any installed work that is not coordinated and that interferes with other contractor's work shall be removed or relocated at the installing contractor's expense.

C. Cooperate with the test and balance agency in ensuring compliance with Section 23 05 93 – Testing, Adjusting and Balancing for HVAC. Verify system completion to the test and balance agency (flushing, pressure testing, chemical treatment, filling of liquid systems, proper pressurization and air venting of hydronic systems, clean filters, clean strainers, duct and pipe systems cleaned, controls adjusted and calibrated, controls cycled through their sequences, etc.), ready for testing, adjusting and balancing work. Install dampers, shutoff and balancing valves, flow measuring devices, gauges, temperature controls, etc., required for functional and balanced systems. Demonstrate the starting, interlocking and control features of each system so the test and balance agency can perform its work.

3.09 IDENTIFICATION

A. Identify equipment in mechanical equipment rooms by stenciling equipment number and service with one coat of black enamel against a light background or white enamel against a dark background. Use a primer where necessary for proper paint adhesion. Do not label equipment such as cabinet heaters and ceiling fans in occupied spaces.
B. Where stenciling is not appropriate for equipment identification, engraved name plates may be used.
C. Identify piping not less than once every 30 feet, not less than once in each room, adjacent to each access door or panel, and on both side of the partition where exposed piping passes through walls, floors or roofs. Place flow directional arrows at each pipe identification location. Piping and ductwork labels shall follow owner's labeling and naming standards. Use one coat of black enamel against a light background or white enamel against a dark background for stenciling, or provide snap-on pipe markers as specified in Part 2 – Products.
D. Identify valves with brass tags bearing a system identification and a valve sequence number. Valve tags are not required at a terminal device unless the valves are greater than ten feet from the device or located in another room not visible from the terminal unit. Provide a typewritten valve schedule indicating the valve number and the equipment or areas supplied by each valve; locate schedules in each mechanical room and in each Operating and Maintenance manual. Schedules in mechanical rooms to be framed under clear plastic.
E. Use engraved name plates to identify control equipment.
F. Label fire, smoke and combination fire smoke dampers on the exterior surface of ductwork directly adjacent to access doors using a minimum of 0.5 inch height lettering reading, "SMOKE DAMPER" or "FIRE DAMPER". Smoke and combination fire smoke dampers shall also include a second line listing the individual damper tag. The tags must be coordinated with the mechanical schedules. Utilize stencils or manufactured labels. All other forms of identification are unacceptable. All labels shall be clearly visible from the ceiling access point.

3.10 LUBRICATION

A. Lubricate all bearings with lubricant as recommended by the manufacturer before the equipment is operated for any reason. Once the equipment has been run, maintain lubrication in accordance with the manufacturer's instructions until the work is accepted by owner. Maintain a log of all lubricants used and frequency of lubrication; include this information in the Operating and Maintenance Manuals at the completion of the project.

3.11 SLEEVES AND OPENINGS

A. General:
   1. Sleeves are not required for piping and ducts passing through interior non-rated drywall, plaster, or wood partitions and interior poured concrete walls that have been saw cut or core drilled.
   2. Pack annular space between sleeves and pipe or ducts with fiberglass insulation and seal.
   3. Piping sleeves that pass through fire rated floors, walls, or ceilings shall be provided with a UL listed fire stop material meeting UL 1479 to seal the opening between the pipe and the pipe sleeve to maintain the fire rating.
   4. Provide escutcheon plates on piping to cover sleeve and insulation in finished areas.
   5. Refer to Division 1 for additional information on sleeves and openings.
B. Sleeves Through Floors/Ceilings:
   1. Sleeves shall be installed to extend 1 inch above finished floor with a watertight sealant between floor and sleeve in all mechanical rooms and wet rooms listed below.

2. If a sleeve is not provided, provide 1-1/2 inch angle ring with urethane caulk between the angle and the floor and seal at the corners to form a watertight seal.
   a. Wet Locations:
      1) Mechanical Rooms
      2) Sanitary pumping stations
      3) Storm Pumping Stations
      4) Food service/kitchen areas (behind/under equipment, cabinets, tables, etc.)

3.12 SEALING AND FIRESTOPPING

A. The Contractor shall refer to building life safety drawings for all smoke and fire rates in addition to the mechanical drawings. Any discrepancies shall be brought to the attention of the Architect/Engineer before final addendum.

B. Fire and/or Smoke Rated Penetrations:
   1. Install approved product in accordance with the manufacturer's instructions where pipes penetrate a fire/smoke rated surface. When pipe is insulated, use a product which maintains the integrity of the insulation and vapor barrier.
   2. Where firestop mortar is used to infill large fire-rated floor openings that could be required to support weight, provide permanent structural forming. Firestop mortar alone is not adequate to support any substantial weight.

C. Non-Rated Partitions:
   1. In exterior wall openings below grade, assemble rubber links of mechanical seal to the proper size for the pipe and tighten in place, in accordance with manufacturer's instructions.
   2. At all interior partitions and exterior walls, pipe penetrations are required to be sealed. Apply sealant to both sides of the penetration in such a manner that the annular space between the pipe sleeve or cored opening and the pipe or insulation is completely blocked.
   3. Duct penetrations through non-rated partitions shall require sheet metal escutcheons with fiberglass or mineral wool insulation fill for spaces that include laboratories, clean rooms, animal rooms, kitchens, cart wash rooms, janitor closets, toilet rooms, mechanical rooms, conference rooms, private consultation rooms, and where noted on drawings elsewhere.

3.13 HOUSEKEEPING AND CLEAN UP

A. The Contractor shall clean up and remove from the premises, on a daily basis, all debris and rubbish resulting from its work and shall repair all damage to new and existing equipment resulting from its work. When job is complete, this Contractor shall remove all tools, excess material and equipment, etc., from the site.

END OF SECTION

SECTION 23 05 13
COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 – GENERAL

1.01 SCOPE OF WORK

1. Provide premium efficiency motors for pumps and boilers as specified herein and shown on the drawings.
2. Contractor provide: Premium efficiency motors for air handling units and fans as specified herein and shown on the drawings.

1.02 SECTION INCLUDES

A. Section includes general requirements for single-phase and poly-phase general purpose squirrel-cage induction motors for use on AC powers systems up to 600 Volts. Included are the following sections:
   1. Single Phase Motors
   2. Polyphase Motors
   3. Motors with Multi-Speed Controllers
   4. Motors with Variable Frequency Drives

1.03 RELATED WORK

A. Applicable provisions of Division 1 govern work under this section.
B. Section 23 21 23 – Hydronic Pumps
C. Section 23 34 00 – HVAC Fans
D. Section 23 52 00 – Heating Boilers
E. Section 23 74 13 – Roof Top Air Handling Units
F. Section 23 82 00 – Heating and Cooling Terminal Units

1.04 REFERENCE STANDARDS

A. The following Standards are referenced herein. Utilize the current edition of the referenced Standards unless otherwise noted:
   1. ANSI/IEEE 112 — Test Procedure for Polyphase Induction Motors and Generators.
   2. ANSI/IEEE 841 — Standard for Petroleum and Chemical Industry-Premium-Efficiency, Severe-Duty, Totally Enclosed Fan-Cooled (TEFC) Squirrel Cage Induction Motors-Up to and Including 500 hp.
   3. ANSI/NEMA MG-1 — Motors and Generators
   4. ANSI/NFPA 70 — National Electric Code

1.05 COORDINATION

A. Coordinate features of motors, installed units and accessory devices to be compatible with:
   1. Motor controllers.
   2. Torque, speed and horsepower requirements of the load.
   3. Rating and characteristics of the supply circuit and required control sequence.
   4. Ambient and environmental conditions of the installation location.
B. All starters, overload relay heater coils, disconnect switches, fuses, relays, power wiring, power wiring conduit, push buttons, pilot lights and other devices for the control of motors or electrical equipment are furnished and installed by the Division 26 Contractor unless otherwise noted elsewhere in this Division of Specifications.

PART 2 – PRODUCTS

2.01 GENERAL MOTOR REQUIREMENTS

A. Comply with the requirements of this Section unless stricter requirements are specified in HVAC equipment schedules or Sections.
B. Comply with ANSI/NEMA MG-1 requirements unless otherwise noted.
C. Comply with ANSI/IEEE 841 requirements for all severe-duty motors unless otherwise noted.

2.02 MOTOR CHARACTERISTICS

A. Motors shall be continuous duty at ambient temperature of 40°C and an altitude of 3,300 feet above sea level.
B. Capacity and torque characteristics shall be suitable to start, accelerate and operate the connected loads at the designated speeds, as the installed altitude and environment with the indicated operating sequence without exceeding the nameplate ratings or considering the service factor of the motor.
C. Perform dynamic balancing and test motors after manufacture. Self-excited vibration velocity of motors shall not exceed limits set forth in NEMA MG-1, Part 7.
D. Motors shall be standard, off the shelf, readily available for replacement. Special or customize motors will not be acceptable unless pre-bid approved.

2.03 SINGLE PHASE MOTORS

A. Motors 1/20 horsepower and smaller shall be shaded-pole type.
B. Motors larger than 1/20 horsepower through 1/3 horsepower shall be one of the following to suit the starting torque and other requirements of the specific motor application:
   1. Permanent-split capacitor.
   2. Capacitor start, capacitor run.
C. Multi-speed motors shall be variable torque, permanent-split capacitor type.
D. Bearings shall be pre-lubricated, anti-friction ball bearing or sleeve bearing type suitable for radial and thrust loading.
E. Thermal protection shall be internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to the temperature rating of the motor insulation. Thermal-protection device shall automatically reset when the motor temperature returns to a normal range.

2.04 POLYPHASE MOTORS

A. Motors ½ horsepower and larger shall be NEMA MG-1, Design B medium induction polyphase motors unless otherwise noted. Motors shall random wound squirrel cage copper bar rotors.
B. Motors shall be 200 volt motors unless otherwise noted.
C. Motors shall be premium efficiency, meeting the requirements of NEMA MG-1.
D. Motors shall be 4-pole (nominal 1800 rpm) unless otherwise noted.
E. Service factor of motor shall be 1.15 unless otherwise noted.
F. Motors windings and leads shall be copper.
G. Motor insulation shall be Class F unless otherwise noted. Motor temperature rise shall match the motor insulation.
H. Motors 15 horsepower and larger shall be NEMA Starting Code F or Starting Code G.
I. Motors smaller than 15 horsepower shall utilize the manufacturer's starting characteristics.
J. Motor enclosures shall be open drip-proof unless totally enclosed fan-cooled, total enclosed non-ventilated, explosion-proof or encapsulated motors are specified in other Sections.
K. Motor enclosures for motor frame sizes 324T and larger shall be cast iron.
L. Motor enclosures for motor frame sizes smaller than 324T shall be rolled steel or cast iron.
M. Bearings shall be regreasable, shielded, anti-friction ball bearing type suitable for radial and thrust loading. Bearings shall be rated for a minimum ABMA 9, L10 life of 80,000 hours. Stamp the bearing sizes on the motor nameplate.
N. Bearings on motors serving belt driven equipment shall utilize a bearing load calculated with NEMA minimum v-belt pulley with centerline at the end of the NEMA standard shaft extension.

2.05 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors used with Multi-Speed Controllers:

1. Variable torque multi-speed motors shall be consequent-pole, single winding for motors with 2:1 speed ratio.
2. Variable torque multi-speed motors shall be separate winding for motors with a speed ratio other than 2:1.
3. Match the wiring connection requirements for the controller with the required motor leads.
4. Provide terminals in motor terminal box suited to the control method.
5. Furnish motors compatible with reduced voltage starting on the following equipment:

B. Motors used with Variable Frequency Drives (VFDs):
1. Motors shall be inverter duty rated motors, suitable for use on variable frequency drives, including but not limited to motor cooling. Motors shall be rated for variable torque with a 4:1 speed range.
2. Motors shall be Class F temperature rise with Class H insulation.
3. Motors shall comply with NEMA MG-1 Part 31 to provide windings capable of withstanding 1600 peak volts with a rise time of 0.1 µs.
4. Provide bearing protection grounding rings to bleed current from the motor shaft to the motor casing for all motors 5 horsepower or more.
5. Comply with NEMA MG-1 requirements for thermally protected motors.
6. Motors shall not have any carrier frequency or lead length restrictions. If restrictions cannot be eliminated, any required restrictions must be appropriate for the specified and scheduled motor applications.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Mount motors on a rigid base designed to accept a motor, using metal shims as required under each mounting foot to obtain a secure installation.
B. Inspect and align each motor when direct coupled to the driven device. Alignment shall be within HVAC equipment manufacturer's limits.
C. Perform dynamic balancing and test motors for vibration after manufacture. Self-excited vibration velocity of motors shall not exceed 0.157/0.06 inches per second at bearing caps.
D. Inspect and align each motor when flexible coupled to the driven device. Use a dial indicator to check angular misalignment of the two shafts. Adjust the motor position as required so that the angular misalignment of the shafts does not exceed 0.002" per inch diameter of the coupling hub or the HVAC equipment manufacturer's limits, whichever is more stringent. Use a dial indicator to check the shaft for run-out to assure concentricity of the shafts. Adjust as required so that run-out does not exceed 0.002" per inch diameter of the coupling hub or the HVAC equipment manufacturer's limits, whichever is more stringent.
E. Inspect and align each motor when connected to the driven device by means of a belt drive. Mount motor sheaves on the appropriate shafts as recommended by the equipment and motor manufacturers. Use a straight edge to check alignment of the sheaves. Reposition the sheaves as required to obtain the proper alignment. After the sheaves are aligned, adjust the motor base as required so that the belt(s) can be added and then tighten the motor base so that the belt tension is in accordance with the drive manufacturers recommendations. Frequently check the belt tension during the first 24 hours of operation and again after 80 hours of operation for proper belt tension. Adjust belt tension as required.

3.02 START-UP

A. Test start each motor to verify proper rotation prior to operating system.
B. Lubricate all motors as recommended by motor manufacturer. Record lubrication material used and frequency of use. Include this lubrication log in the Operation and Maintenance manuals.

END OF SECTION

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SECTION 23 05 14
VARIABLE FREQUENCY DRIVES

PART 1 – GENERAL

1.01 SCOPE OF WORK
A. Variable Frequency Drives for pumps, and fans as specified herein and shown on the drawings.

1.02 SECTION INCLUDES
A. This section includes variable frequency drives, bypass starters and line reactors. Included are the following topics:
   1. Variable Frequency Drives

1.03 RELATED WORK
A. Applicable provisions of Division 1 govern work under this section
B. Section 23 05 00 – Common Work Results for HVAC
C. Section 23 09 93 – Sequence of Operations for HVAC Controls
D. Section 23 21 23 – Hydronic Pumps
E. Section 23 34 00 – HVAC Fans
F. Section 26 05 26 – Grounding and Bonding for Electrical Systems
G. Section 26 05 29 – Hangers and Supports for Electrical Systems
H. Section 26 05 53 – Identification for Electrical Systems
I. Section 26 27 02 – Equipment Wiring Systems

1.04 SUBMITTALS
A. Refer to Section 23 05 00 – Common Work Results for HVAC, Submittals. In addition to general content specified under Section 23 05 00 – Common Work Results for HVAC, supply the following submittals:
   1. Variable Frequency Drives
B. Include physical, electrical, and performance characteristics of each variable frequency drive and associated components, including dimensions; weight; input and output performance; voltage, phase, current and overcurrent characteristics; installation instructions; protective features; wiring and block diagrams indicating specified options; electrical noise attenuation equipment where required to meet the criteria specified; line side voltage notch wave form and line side current harmonics; certified efficiency versus load and speed curves; and required operating environment.

1.05 REFERENCE STANDARDS
A. ANSI/IEEE 519 Guide for Harmonic Control and Reactive Compensation of Static Power Converters

1.06 WARRANTY
A. Warranty shall be for a period of twenty-four (24) months from date of project Substantial Completion. Further, the warranty shall include all parts, labor, travel time, administrative costs, overhead, travel expenses, technical support and any and all other costs to provide the warranty service.

1.07 OPERATION AND MAINTENANCE DATA
A. All operations and maintenance data shall comply with the submission and content requirements specified in Section 23 05 00 – Common Work Results for HVAC.

1.08 EQUIPMENT STARTUP
A. Provide the services of a factory trained and certified technician to approve the installation; start-up, test, and adjust for proper operation of the unit(s). Upon completion of the equipment startup, submit a complete manufacturer's field report, including startup and test log, signed by the factory trained technician. Coordinate with the Temperature Control Contractor and the Balancing Contractor. The startup shall be coordinated with Division 26. Electrical and shall be completed within ten (10) working days from the startup date as set by the owner's representative.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. ABB, Toshiba, Danfoss, Trane/Danfoss, GE Fuji, Emerson, Yaskawa, Eaton/Cutler Hammer, Mitsubishi, Allen Bradley

2.02 DESIGN AND CONSTRUCTION

A. The unit shall be variable torque, modular design for control of the motors as specified in Division 23 and rated at the motor full load nameplate amps.
B. Unit shall be U.L. listed, solid state, microprocessor-based with a pulse width modulated (PWM) output wave form (none others are acceptable).
C. VFD shall employ a full wave bridge rectifier and capacitors to minimize the ripple of the rectified voltage to maintain near constant DC voltage. Insulated gate bipolar transistors (IGBT's) shall be employed as the output switching device.
D. VFD package shall contain the equivalent of 5% impedance to reduce harmonic distortion. The 5% equivalent impedance shall be provided in the form of a DC bus choke, an input AC line reactor in each phase, or a combination of the two methods.
E. Control circuitry shall be plug-in, plug-out modular basis with corrosion resistant coating on printed circuit boards.
F. Units to be suitable for an operating environment from 0°C to 40°C temperature and humidity up to 90% non-condensing.
G. Electrically and physically isolate control circuitry and conductors from power circuitry and power conductors. Control conductors and power conductors shall not be run in the same pathway.
H. All power wiring from VFD output to motor shall be type XHHW-2 insulation, single conductor wire.
I. The unit enclosure shall be NEMA 1 as required for the application minimum and all components shall be fully factory assembled and tested prior to leaving the manufacturing facility.
J. Include the following operating and monitoring devices mounted on the front cover:
    1. A disconnect switch or circuit breaker to de-energize both the drive and bypass circuit with door interlocked handle and lock-open padlocking provisions
    2. Operating mode selector switch marked "hand-off-auto"
    3. Manual speed adjustment via keypad, mounted on the door
    4. Manual bypass selector switch to select power through drive or bypass (if a bypass is provided)
K. Provide a manual bypass circuit and bypass starter to transfer from variable frequency drive operation to bypass operation (if a bypass is provided).

2.03 PERFORMANCE REQUIREMENTS

A. Units shall be suitable for input power of electrical system as scheduled on the drawings ±10%, 3 phase, 60 Hertz nominal.
B. Use a current limiting control device to limit output current to 110% continuous for one minute; also refer to Protection Features in this section. Full load output current available from drive shall not be less than motor nameplate amperage. Full load amp rating of VFD shall not be less than the values indicated in the NEC Table 430-150.
C. Output power shall be suitable for driving standard NEMA B design, three phase alternating current induction motors at full rated speed with capability of 6:1 turndown.
D. Additional performance capabilities to include the following:
    1. Ride through a momentary power outage of 15 cycles
    2. Start into a rotating load without damage to drive components or motor
    3. Capable of automatic restart into a rotating load after a preset, adjustable time delay following a power outage
    4. Input power factor: Min 0.95 throughout the speed range
    5. Minimum efficiency: 95% at 100% speed, 85% at 50% speed

2.04 CONTROL FEATURES

A. Use control circuits compatible with input signal from temperature control system in automatic mode and from manual speed control in manual mode. Vary motor speed in response to input control signal.

Include components necessary to accept the signal from the temperature control system in the form that it is sent. Refer to Division 23.

B. Include the following additional control features:
   1. Hand-Off-Automatic (HOA) selector switch to select local or remote start/stop and speed control
   2. Analog input, selectable 0-10v or 4-20 mA, for automatic control from temperature control system
   3. Local speed control at the VFD
   4. Adjustable acceleration and deceleration rate so that the time period from start to full speed and from full speed to stop can be field adjusted
   5. Adjustable minimum and maximum speed settings for both automatic and manual modes of operation
   6. Manual transfer bypass circuit
   7. Field adjustment of minimum and maximum output frequency
   8. Two (2) sets of programmable form "C" contacts for remote indication of variable frequency drive condition. Note: default programming to be set for "Drive Run & Fault".
   9. Illuminated display keypad.
   10. External Fault indicator
   11. One (1) input for a N.O. dry contact type input for a 2-wire remote start/stop
   12. One (1) input for a N.C. dry contact type input for external faults: (freezestats, fire alarm, smokes, etc.). This input shall be factory wired to prevent both the VFD and bypass starter operation when external fault is present.
   13. One (1) N.O. dry contact output for proving motor status. This output shall be programmed to detect belt or coupling break that would remove the load from the motor. The dry contact will open on loss of load or VFD being off.
   14. PID control loop capable of VFD control from an external device connected to VFD analog input.

C. The VFD controller shall convert VFD information into the BACnet MSTP protocol that will be compatible with the building direct digital energy management system (EMS) supplied on the project. This output shall be through a serial interface port capable of two-way communication with the building EMS provided on this project. Final connection shall not require any additional intermediate gateway devices to provide throughput of data. The following data shall be provided at a minimum:
   1. Fault condition
   2. Speed
   3. Amperage
   4. Frequency
   5. Voltage
   6. Bypass status (if supplied)

2.05 PROTECTION FEATURES

A. Use electronic protection circuitry in the power circuits to provide an orderly shutdown of the drive without blowing fuses or tripping circuit breakers and prevent component loss under the following abnormal conditions:
   1. Activation of any safety device
   2. Instantaneous overcurrent and/or over voltage of output
   3. Power line overvoltage and undervoltage protection
   4. Phase loss
   5. Single and three phase short circuiting
   6. Ground faults
   7. Control circuit malfunction
   8. Over temperature
   9. Output current over limit.

B. Provide the following additional protective features:
   1. Input transient overvoltage protection up to 3000 volts per ANSI 37.90A
   2. DC bus fusing or other electronic controls which limit the rate of rise of the DC bus current and de-energizes the drive at a predetermined current level
   3. Fusing for the control circuit transformer
   4. Grounded control chassis
   5. Devices and/or control circuitry to ensure that the variable frequency drive and bypass starter are not both energized and driving motor simultaneously

2.06 DIAGNOSTICS

A. Provide an English character display (no error codes) with indicators for the following:
   1. Phase loss
   2. Ground fault
   3. Overcurrent
   4. Overvoltage
   5. Under voltage
   6. Over temperature
   7. Overload
   8. DC bus status

2.07 QUALITY ASSURANCE TESTS

A. Use a factory heat stress test to verify proper operation of all functions and components under full load.
B. Field performance test of variable frequency drives to determine compliance with this specification will be performed at owner's discretion and may include any specified feature, including operation of protective devices through a simulated fault. Contractor will pay for initial testing. Should drive be found deficient by this testing, drive manufacturer will be required to make changes necessary to bring unit(s) into compliance with specified performance and demonstrate this performance by retesting. Cost of changes and retest will be by this contractor.
C. Variable frequency drive manufacturer or designated representative to perform a field test of each drive, in the presence of the owner's representative, for the following items:
   1. Provide general inspection to verify proper installation
   2. Demonstrate drive reaction to simulated power interruptions of two seconds and sixty seconds
   3. Demonstrate adequate protection during switching from variable frequency drive operation to bypass starter operation and back again

2.08 AC INPUT LINE REACTORS

A. When needed to comply with the requirement for 5% equivalent impedance, furnish and factory install AC input line reactors.
B. Line reactors shall be installed in each phase of the AC input side of the VFD and mounted within a common enclosure with the VFD.
C. Line reactor shall be a three phase inductor, iron core, 600V, Class H insulation, 115 degree C rise, copper windings with screw type terminal blocks.

PART 3 – EXECUTION

3.01 VARIABLE FREQUENCY DRIVES

A. Install where indicated on drawings and in accordance with approved submittals and manufacturer's published recommendations. Installation to be by the Division 26 - Electrical contractor.
B. Input power wiring shall be installed in a separate conduit, output power wiring shall be installed in a separate conduit and control wiring shall be installed in a separate conduit. Do not mix input power, output power, or control wiring in a common conduit. Separate conduits for input and output power wiring shall be provided for each motor. Input and output power wiring for more than one motor shall not share a common conduit. Power wiring shall be furnished and installed by the Div. 26 contractor. If provided, do not mount output line filter above the drive.
C. Control signal for drive will be provided under Division 23.
D. Temperature Control Contractor will furnish and install the required temperature control wiring in metal conduit and in accordance with Division 26 - Electrical of this specification.

3.02 TRAINING

A. See Section 23 05 00 – Common Work Results for HVAC for general training requirements.

END OF SECTION

SECTION 23 05 15
PIPING SPECIALTIES

PART 1 – GENERAL

1.01 SCOPE OF WORK
A. Contractor shall provide all labor and materials for a complete system in this specification section.

1.02 SECTION INCLUDES
A. This section contains specifications for HVAC piping specialties for all piping systems. Included are the following topics:
   1. Thermometers
   2. Thermometer Sockets
   3. Test Wells
   4. P/T (Pressure/Temperature) Test Plugs
   5. Hose Connection Caps
   6. Pressure Gauges
   7. Flexible Piping Connections
   8. Expansion Loops
   9. Strainers
   10. Water Filters
   11. Centrifugal Separators
   12. Expansion Tanks
   13. Air Separators
   14. Air Vents
   15. Suction Diffusers
   16. Vacuum Breakers
   17. Flow Sensing Devices
   18. Cold Water Meters
   19. Water Treatment Bypass Feeder

1.03 RELATED WORK
A. Applicable provisions of Division 1 govern work under this section.
B. Conform to Standards of Expansion Joint Manufacturer's Association.
C. Section 23 05 00 – Common Work Results for HVAC
D. Section 23 05 23 – General Duty Valves for HVAC Piping
E. Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment
F. Section 23 05 48 – Vibration and Seismic Controls for HVAC Piping and Equipment
G. Section 23 07 00 – HVAC Insulation
H. Section 23 09 14 – Pneumatic and Electric Instrumentation and Control Devices for HVAC
I. Section 23 11 00 – Facility Fuel Piping
J. Section 23 15 13 – General Service Compressed Air Piping
K. Section 23 21 13 – Hydronic Piping

1.04 SUBMITTALS
A. Refer Section 23 05 00 – Common Work Results for HVAC, Submittals. In addition to the general content specified under Section 23 05 00 – Common Work Results for HVAC, supply the following submittals:
   1. Thermometers
   2. Thermometer Sockets
   3. Test Wells
   4. P/T (Pressure/Temperature) Test Plugs
   5. Hose Connection Caps
   6. Pressure Gauges
   7. Flexible Piping Connections

8. Expansion Loops
9. Strainers
10. Water Filters
11. Centrifugal Separators
12. Expansion Tanks
13. Air Separators
14. Air Vents
15. Suction Diffusers
16. Vacuum Breakers
17. Flow Sensing Devices
18. Cold Water Meters
19. Water Treatment Bypass Feeder

B. Required for all items in this section. Include materials of construction, dimensional data, ratings/capacities/ranges, pump curves with net positive suction head requirements, pressure drop data where appropriate, and identification as referenced in this section and/or on the drawings.

1.05 REFERENCE STANDARDS

A. ASME B31 Standards of Pressure Piping
B. ASTM A53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
C. ASTM B650 Standard Specification for Electrodeposited Engineering Chromium Coatings on Ferrous Substrates
D. ANSI/AWWA Standard C700 Cold-Water Meters – Displacement Type, Bronze Main Case

1.06 QUALITY ASSURANCE

A. Refer to Division 1 for equals and substitutions.

1.07 DESIGN CRITERIA

A. All piping specialties are to be rated for highest pressures and temperatures in the respective system in accordance with ASME B31, but not less than 125 psig unless specifically indicated otherwise. Base expansion calculations on 50° F (10° C) installation temperature to 240° F (115° C) for hot water heating.

1.08 WARRANTY

A. For slip expansion joints provide published five (5) year warranty and service guarantee including, but not limited to leak free.

1.09 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified in Section 23 05 00 – Common Work Results for HVAC.

PART 2 - PRODUCTS

2.01 THERMOMETERS

A. Scale Ranges

Service	**Scale Range, °F**	**Min. Increment, °F**
Hot Water	30 - 240	2

B. Stem type thermometers
   1. Manufacturers: Ashcroft, Marsh, Taylor, H. O. Trerice, U. S. Gauge, Weiss, Weksler.
      Stem Type, cast aluminum case, nine inch scale, clear acrylic window, adjustable angle brass stem with stem of sufficient length so the end of the stem is near the middle of a pipe without reducing the thickness of any insulation, red indicating fluid, black lettering against a white background.

2.02 THERMOMETER SOCKETS

A. Brass with threaded connections suitable for thermometer stems and temperature control sensing elements in pipeline. Furnish with extension necks for insulated piping systems.

2.03 TEST WELLS

A. Similar to thermometer sockets except with a brass cap that thread into the inside of the test well to prevent dirt from accumulating. Secure cap to body with a short chain. Furnish with extension necks, where appropriate, to accommodate the pipeline insulation.

2.04 P/T (PRESSURE/TEMPERATURE) TEST PLUGS

A. Brass plug with 1/4" NPT threads, EPDM or neoprene valve core, knurled cap with cap strap. Use extended length plugs to clear insulated piping. Adaptors shall have 1/4" FPT connection for standard pressure gauges.

2.05 HOSE CONNECTION CAPS

A. Hose connection caps shall be pressure rated for 150 psig at 180 deg F.

2.06 PRESSURE GAUGES

A. Manufacturers: Ametek/U. S. Gauge Division, Ashcroft, Marsh, Taylor, H. O. Trerice, Weiss, Weksler.

B. Cast aluminum case of not less than 4.5 inches in diameter, double strength glass window, black lettering on a white background, phosphor bronze bourdon tube with bronze bushings, recalibration from the front of the dial, 99% accuracy over the middle half of the scale, 98.5% accuracy over the remainder of the scale, with scale range as follows:

Service	**Scale Range, psig**	**Min. Increment, psig**
Hot Water	0-60	2

C. Pressure Snubbers: Bronze construction, suitable for system working pressure, 1/4" size.

D. Gauge Valves: Use valves as specified in Section 23 05 23 – General Duty Valves for HVAC. For water systems, use 1/4" ball valves. For steam systems, use 1/4" gate valves suitable for system working pressure.

2.07 FLEXIBLE PIPING CONNECTIONS

A. Refer to Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.

2.08 EXPANSION LOOPS

A. Provide expansion loops indicated on the drawings and details.

2.12 STRAINERS

A. Manufacturers: Armstrong, Hoffman, Illinois, Keckley, Metraflex, Mueller Steam, or Sarco.

B. Water Systems: Y type; cast iron body; stainless steel screens; bolted or threaded screen retainer tapped for a blowoff valve; threaded body in sizes through 2 inch and rated at not less than 175 psi WOG; flanged body in sizes over 2 inch and rated at not less than 125 psi WOG at 240°F. Screen to be 20 mesh for line sizes 2 inch and less, 0.125 inch perforations for line sizes 2-1/2 inch through 4 inch, and 0.25 inch perforations for line sizes 5 inch and larger.

C. Basket type: Cast iron body with clamped cover; stainless steel screens; body tapped for a blowoff valve; 125 psig flanged body for 2 1/2" and larger; 0.125 inch perforations for line sizes 2-1/2 inch through 4 inch, and 0.25 inch perforations for line sizes 5 inch and larger.

2.13 WATER FILTERS

A. Manufacturers: Commercial Filters (Carborundum), Pall Trinity Micro Corporation, Dover Corp./Ronningen-Petter Division, Rosemont.

B. Construct housing of carbon steel rated at 125 psig at 250°F. Finished product to bear the ASME unfired pressure vessel stamp. Use a gasketed clamped cover of cast iron or steel to provide filter access. Use threaded pipe connections for nominal pipe sizes 2 inch and smaller, flanged pipe connections for nominal pipe sizes 2-1/2 inch and larger; mechanical grooved pipe connections may be substituted for all sizes when allowed by Section 23 21 13 – Hydronic Piping. Include a floor mounting support.
C. Furnish 4 sets of cleanable nylon bag filters, two capable of removing 95% of solids that are 10 microns or large and two cable of removing 95% of solids that are 50 microns or larger
D. Assembly to function properly with pressure differentials to 75 psi.

2.15 CENTRIFUGAL SEPARATORS

A. Centrifugal vortex type separator constructed of carbon steel and furnished with flanged inlet and outlet, collection chamber that is openable for inspection or cleaning, flanged separator section to allow interior inspection or cleaning, flanged collection chamber outlet for removing collected material, a relief line from the venturi chamber to the collection chamber to improve solids collection, 1/2 inch gauge connections in the main inlet and outlet connections, and suitable for an operating pressure of not less than 125 psig. Assembly to be capable of removing 98% by weight of all particles 75 microns or larger and having a specific gravity of at least 1.8.
B. Furnish with a purge assembly consisting of a motorized ball valve and a controller suitable for 120 volt operation and mounting independently near the valve. Ball valve to be suitable for 125 psig operation at 100°F. Controller to allow setting of purge time between 15 seconds and 30 minutes with frequencies between one minute and 16 hours. Include controls to allow automatic operation, manual operation, or de-energizing the controller.

2.17 EXPANSION TANKS

A. Manufacturers: Amtrol/Thrush, Armstrong Pumps, Bell and Gossett, Taco, Wessels.
B. Standard Type: Steel construction, tested and stamped in accordance with Section 8D of the ANSI/ASME Code and furnished with the National Board Form U-1, red line gauge glass with guard and cocks, drain valve with hose adapter, air charging device, system connection, rated for not less than 125 psi working pressure, prime coated, mounting saddles for horizontal installation or base for vertical installation, size/capacity as indicated on the drawings.
C. Bladder Type: Steel construction, tested and stamped in accordance with Section 8D of the ANSI/ASME Code and furnished with the National Board Form U-1, rated for not less than 125 psig working pressure, precharged with air to the initial fill pressure indicated on the drawings, butyl replaceable bladder suitable for fluid temperatures to 220°F, and furnished with a tank drain connection, system connection, mounting saddles for horizontal installation or base for vertical installation, prime coated, size/capacity as indicated on the drawings. Tank and bladder construction must allow field replacement of the bladder on its failure.

2.18 AIR SEPARATORS

A. Manufacturers: Amtrol/Thrush, Armstrong Pumps, Bell and Gossett, Taco.
   1. Bronze body with nonferrous internal parts, screwdriver operated, designed to relieve air from the system when vent is opened, rated at not less than 125 psig at 220°F.
B. 1-1/2 inch and smaller: Cast iron construction, suitable for in-line installation, top and bottom connections for use with expansion tanks specified above, rated at not less than 125 psig at 220°F.

2.19 AIR VENTS

A. Manual Key Type Vents: Bell and Gossett Model 4V; Eaton/Dole Model 9, 9B, or 14A.
   1. Bronze body with nonferrous internal parts, screwdriver operated, designed to relieve air from the system when vent is opened, rated at not less than 125 psig at 220°F.
B. Manual Ball Valve Vents: Provide 1/4" ball valves for manual venting of air. Reference Section 23 05 23 – General Duty Valves for HVAC.
C. Automatic Vents:
   1. Thrush Model 720, Bell and Gossett Model 107, Watson McDaniel Model AV813W
   2. Cast iron body with nonferrous internal parts, designed to vent air automatically with float principle without allowing air to enter the system, rated at not less than 125 psig at 220°F.

2.20 SUCTION DIFFUSERS

A. Manufacturers: Amtrol/Thrush, Armstrong Pumps, Bell and Gossett, Taco.

	Amtrol	***Armstrong***	***B&G***	***Taco***
Body	***CI/steel***	***CI***	***CI***	***CI***
Straightening		***c:CI/steel***	***steel***	***CI***
Vanes		***o:SS/CI***		
Strainer	***Galv. Steel***	***SS***	***c:Steel o:SS***	***SS***
Startup Strainer		***Brass***	***c:Bronze o:None***	***Bronze***
Max. psi	***175***	***175***	***175***	***175***
Max deg. F	***250***	***300***	***250***	***250***

B. Designed to replace the suction line strainer and the long entrance pipe at a pump suction; constructed with a strainer blowdown connection, provisions for a field supplied support foot, and bolted flange for strainer removal and cleaning; rated at not less than 125 psi working pressure at not less than 250°F.

C. Closed Systems: Body constructed of cast iron, ductile iron or carbon steel; cast iron or steel straightening vanes; steel, galvanized steel or stainless steel strainer; brass or bronze fine mesh startup strainer, strainer blowdown connection, inlet pressure gauge connection, provisions for a field supplied support foot, and bolted flange for strainer removal and cleaning; rated at not less than 125 psi working pressure at not less than 250°F.

2.21 VACUUM BREAKERS

A. Where vacuum breakers are not furnished integral with equipment by the equipment manufacturer, provide 15 degree swing check valve. Reference Section 23 05 23 - General Duty Valves for HVAC.

2.22 FLOW SENSING DEVICES

A. For water flow sensing devices 2 inch and smaller, use balance valves as specified in Section 23 05 23 – General Duty Valves for HVAC Piping.

2.24 COLD WATER METERS

A. Bronze body, minimum 3/4" NPT ends, positive displacement disc type meter with built-in strainer, magnetic drive and thermoplastic disc/register gearing. Meters shall meet ANSI/AWWA Standard C700. Sealed register shall be odometer type totalization display having 10,000,000 gallon capacity. Register shall also have 360 degree sweep hand with 10 gallon range and 0.1 per gallon increments. Meters shall be suitable for 150 psig pressure at 80 degrees F. Badger Recordall Disc Meter, Carlon Meter Co., Neptune, Hersey, Venture Measurement Niagara.

2.27 WATER TREATMENT BYPASS FEEDER

A. Refer to Section 23 25 00 – HVAC Water Treatment for Bypass Feeders.

PART 3 - EXECUTION

3.01 GENERAL

A. Install specialties in accordance with manufacturer's instructions to permit intended performance.

3.02 THERMOMETERS

A. Stem Type: Install in piping systems as indicated on the drawings and/or details using a separable socket in each location. Install thermometers where these can be easily read from normal operating level.

3.03 THERMOMETER SOCKETS

A. Install at each point where a thermometer or temperature control sensing element is located in a pipeline.

3.04 TEST WELLS

A. Install in piping systems as indicated on the drawings and/or details wherever provisions are needed for inserting a thermometer at a later date.

3.05 P/T (PRESSURE/TEMPERATURE) TEST PLUGS

A. Install in piping systems as indicated on the drawings and/or details. Do not insulate over test plugs.

3.06 PRESSURE GAUGES

A. Install in locations where indicated on the drawings and/or details, including any gauge piping, with scale range appropriate to the system operating pressures. Install where pressure gauges where these can be easily read from normal operating level.
B. Pressure Snubbers: Install in gauge piping for all gauges used on water services.
C. Gauge Valves: Install at each gauge location as close to the main as possible and at each location where a gauge tapping is indicated.

3.07 EXPANSION LOOPS

A. Install where indicated on drawings or details, locating anchors and guides as detailed. Provide piped expansion loops for all horizontal pipe runs serving hot water supply and return piping. Rigidly anchor pipe to building structure; provide pipe guides so that movement takes place along axis of pipe only.

3.11 STRAINERS

A. Install all strainers where indicated on the project details, allowing sufficient space for the screens to be removed. Rotate screen retainer where required by the installation so blowdown can remove accumulated dirt from the strainer body.
B. Water Systems: Install a ball valve for blowdown in the tapped screen retainer; valve to be the same size as the tapping.

3.12 WATER FILTERS

A. Install water filter in a bypass arrangement around system pump where indicated on drawings. Allow sufficient clearance at the top of the unit for filter removal and replacement. Anchor filter support stand to a housekeeping pad. Install a shutoff valve upstream and downstream of the filter. Install a pressure gauge with gauge valves, piped so the pressure differential across the filter can be read.
B. Install the 50 micron filters after the piping system has been cleaned and flushed. Install one set of 10 micron filters when the 50 micron filters need replacing. Give the other set of 10 micron filters and the other set of 50 micron filters to the Owner.

3.16 EXPANSION TANKS

A. Install tanks where indicated on the drawings, coordinating concrete base installation with the General Contractor or fabricating steel supports to suit the application. Install all specified tank accessories.
B. Standard Tanks: Charge tank with the proper amount of air and water during the initial fill after the system has been flushed and cleaned.
C. Bladder Tanks: Verify proper air charge; recharge as necessary. Install an isolation valve in the piping connecting the tank to the system. In the piping between the tank and the isolation valve, install a pressure gauge and a drain valve with a hose adapter. Install a drain valve with hose adapter in the drain connection of the tank. Make sure that all drains are accessible, and a hose can be attached.

3.17 AIR SEPARATORS

A. Mount in hot water lines as indicated on the drawings/details. Install ball valve with hose adapter in bottom blowdown connection.
B. Provide valved drain and hose connection on blow-down connection. Open the drain valve and blowdown the strainer after system cleaning and again after 30 days of operation.

3.18 AIR VENTS

A. Manual Key Type Vents: Bell and Gossett Model 4V; Eaton/Dole Model 9, 9b, or 14a.

1. Install at all high points where air may collect and not be carried by the system fluid. Use a soft Type L copper "pigtail" so the vent can be positioned for venting and collecting any water that might escape.

B. Manual Ball Valve Vents: Install at all high points where air may collect and not be carried by the system fluid, on air handling coils, and where indicated elsewhere as shown on drawings and details. Vents included at terminal units are acceptable only where terminal unit is at the high point of the system.

C. Automatic Vents: Install on the top of air separators on systems using bladder type expansion tanks. Install at other locations as indicated on the drawings or details. All locations to have a ball valve installed upstream of the vent for maintenance purposes. Provide vent tubing to nearest drain. Coordinate routing with owner before installation.

3.19 SUCTION DIFFUSERS

A. Install at each pump suction connection for end suction pumps where shown. Provide sufficient space for removal of the strainer. Install a capped drain valve in the blowdown connection. Install support below the suction diffuser so the weight of the suction piping does not rest on the pump suction connection.

B. Install a pressure gauge across the suction diffuser, valved so that a single gauge can be used to read the inlet pressure and the outlet pressure across the strainer. Use gauge valves as specified with the gauges. This gauge can be the same one used to read pressures across the pump. Select gauge range appropriate to the system pressures.

C. Open the drain valve and blowdown the strainer after system cleaning and again after 30 days of operation. If the unit is furnished with a fine mesh startup strainer, remove this strainer after the system has been flushed and cleaned.

3.20 VACUUM BREAKERS

A. Install on steam heating coils and elsewhere as indicated on the drawings and/or details.

3.21 FLOW SENSING DEVICES

A. Paddles on flow switches shall be of size recommended by manufacturer for pipe size in which it is installed.

B. Give portable meter to owner at the completion of all balancing work.

3.23 COLD WATER METERS

A. Install water meters on makeup water line to hot water and chilled water systems ahead of water pressure reducing valve.

END OF SECTION

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SECTION 23 05 23
GENERAL DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.01 SCOPE OF WORK
A. Contractor shall provide all labor and materials for a complete system in this specification section.

1.02 SECTION INCLUDES
A. This section includes valve specifications for all HVAC systems except where indicated under Related Work. Included are the following topics:
   1. Water System Valves
      a. Gate Valves (Hydronic)
      b. Ball Valves (Hydronic)
      c. Butterfly Valves (Hydronic)
      d. Globe Valves (Hydronic)
      e. Swing Check Valves (Hydronic)
      f. Spring Loaded Check Valves (Hydronic)
      g. Balance Valves
      h. Drain Valves (Hydronic)
      i. Combination Shut-off, Check, and Balancing Valves
      j. Water Pressure Reducing Valves
      k. Water Relief Valves
      l. Self-Contained Control Valves
   2. Natural Gas Systems
      a. Shut-off Valves (Gas)
      b. Gas Pressure Regulators (Gas)
   3. Gauge Valves
   4. Stem Extensions

1.03 RELATED WORK
A. Applicable provisions of Division 1 govern work under this section.
B. Section 23 05 00 – Common Work Results for HVAC
C. Section 23 05 15 – Piping Specialties
D. Section 23 09 14 – Pneumatic and Electric Instrumentation and Control Devices for HVAC

1.04 SUBMITTALS
A. Refer to Section 23 05 00 – Common Work Results for HVAC. In addition to the general content specified under Section 23 05 00 – Common Work Results for HVAC, supply the following submittals:
   1. Water System Valves
      a. Gate Valves (Hydronic)
      b. Ball Valves (Hydronic)
      c. Butterfly Valves (Hydronic)
      d. Globe Valves (Hydronic)
      e. Swing Check Valves (Hydronic)
      f. Spring Loaded Check Valves (Hydronic)
      g. Balance Valves
      h. Drain Valves (Hydronic)
      i. Combination Shut-off, Check, and Balancing Valves
      j. Water Pressure Reducing Valves
      k. Water Relief Valves
      l. Self-Contained Control Valves

2. Natural Gas Systems
   a. Shut-off Valves (Gas)
   b. Gas Pressure Regulators (Gas)
3. Gauge Valves
4. Stem Extensions

B. Contractors shall submit a schedule of all valves indicating type of service, dimensions, materials of construction, and pressure/temperature ratings for all valves to be used on the project. Temperature ratings specified are for continuous operation

C. Contractors shall submit critical flow capacity data supplied by the manufacturer for all steam pressure reducing valves. The calculation from the manufacturer shall be the largest obtainable by internal trim change of the reducing valve.

1.05 QUALITY ASSURANCE

A. Refer to Division 1 for equals and substitutions.

1.06 DESIGN CRITERIA

A. Where valves are specified for individual mechanical services (i.e. hot water heating, steam, etc.) all valves shall be of the same manufacturer unless prior written approval is obtained from owner.

1.07 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified in Section 23 05 00 – Common Work Results for HVAC.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Anvil, Apollo, Armstrong, Bell & Gossett, Cash-Acme, Dresser Consolidated, Conval, Crane, Anderson Greenwood and Crosby, Danfoss-Flomatic, DeZurik, Durco, Fisher, Grinnell, Griswold, Hammond, Hancock, Hoffman, Jamesbury, Keystone, Kunkle, Leslie, Lunkenheimer/Cincinnati, Metraflex, Milwaukee, Mueller, Newco, Nexus, Nibco, Powell, RP&C, Sarco, Spence, Stockham, Taco, Tasco, Thrush-Amtrol, Vogt, Watts.

B. All valves shall be designed for operation with not less than 125 lbs. working pressure and of a type permitting repacking while under pressure. Rising stems shall be used wherever possible. Provide valves to allow control of all major branches. All valves 2 inches and larger installed 7 feet on centerline or higher above the floor shall have chain operators.

2.02 WATER SYSTEM VALVES

A. All water system valves to be rated at not less than 125 psig water working pressure at 240°F unless noted otherwise.

B. GATE VALVES:
   1. 2" and smaller: Use ball valves; gate valves will not be accepted in sizes 2" and smaller.
   2. 2-1/2" and larger: Use butterfly valves; gate valves will not be accepted in sizes 2-1/2" and larger.

C. BALL VALVES:
   1. 2" and smaller: Two piece bronze body; threaded or soldered ends, as appropriate to the pipe material; stainless steel or chrome plated brass/bronze ball; conventional port; glass filled teflon seat; threaded packing gland follower; blowout-proof stem; 600 psig WOG.
   2. Valve stems shall allow operators to clear insulation without interference. Provide stem extensions when valve operators interfere with pipe insulation.
   3. Apollo 70-100/200 series, Hammond 8301/8311, Milwaukee BA100/150, Nibco T/S 585-70, Stockham S206/216.
   4. 2-1/2" and over: Ball valves will not be accepted in sizes over 2 inch.

D. BUTTERFLY VALVES:
   1. 2" and smaller: Use ball valves; butterfly valves will not be accepted in sizes 2 inch and smaller.
   2. 2-1/2" and larger: Cast iron body; stainless steel shaft; Teflon, nylatron, or acetal bearings; EPDM resilient seat. Disk to be bronze, aluminum-bronze, nickel plated ductile iron, cast iron with

welded nickel edge, or stainless steel. Pressure rated to 150 psig. Valve assembly to be bi-directionally bubble tight to 150 psig with no downstream flange/pipe attached. Polymid or polyamide coated valves are not acceptable.

3. Valve stems shall allow operators to clear insulation without interference. Provide stem extensions when valve operators interfere with pipe insulation.
4. Use threaded lug type valves for installation with class 125/150 flanges.
5. Centerline series 200, DeZurik BGS II, Keystone Fig. 222, Nibco LD2000 (2-1/2”-12”)/LD1000 (14” and above), Victaulic 300 series (2-1/2”-12”)/709 series (14”-24”).

E. GLOBE VALVES:
1. Do not use globe valves for water service, except in temperature control applications.

F. SWING CHECK VALVES:
1. 2" and smaller: Class 125, bronze body, threaded or soldered ends, regrindable seat, bronze disc, threaded cap, suitable for installation in a horizontal or vertical line with flow upward.
2. Crane 137/1342, Hammond IB912/IB940, Lunkenheimer 2144/2145, Milwaukee 509/1509, Nibco T-413-B/S-413-B, Powell 578/1825, Stockham B-309/B-319.
3. 2-1/2" and larger: Class 125, cast iron body, flanged ends, bronze trim, bolted cap, renewable bronze seat and disc, non-asbestos gasket, suitable for installation in a horizontal or vertical line with flow upward.
4. Crane 373, Hammond IR1124, Lunkenheimer 1790, Milwaukee F2974, Nibco F918, Powell 559, Stockham G-931.

G. SPRING LOADED CHECK VALVES:
1. 2" and smaller: Class 125, bronze body, threaded, solder or wafer ends, bronze trim, stainless steel spring, teflon seat unless only bronze available.
2. APCO 300 series, ConBraCo 61 series, Mueller 303BP, Nibco T-480-Y/S-480-Y, Val-Matic 1400 series.
3. 2-1/2" and larger: Class 125, cast iron or semi-steel body, wafer or globe flanged type, bronze trim, bronze or EPDM seat, stainless steel spring, stainless steel stem if stem is required. Valves with ductile iron in contact with the working fluid will not be accepted.
4. APCO 600 series, Metraflex 900 series, Milwaukee 1800 series, Mueller Steam 101M-AP/105M-AP, Nibco F910 series, Val-Matic 1800 series, Victaulic series 716.

H. BALANCE VALVES:
1. 2" and smaller: Bronze or copper alloy body with calibrated ball, globe or venturi/valve arrangement, integral pointer and calibrated scale to register degree of valve opening, memory stop, drain tapping, threaded or soldered ends, with or without integral unions, P/T or Shraeder pressure taps with integral check valves and seals, adjustable memory stop, protective Yoke, and suitable for 200 psig water working pressure at 250°F.
2. Armstrong CBV, Bell & Gossett Circuit Setter Plus, Griswold Quickset, Nexus Orturi, Nibco 1710 Series, Taco Accu-Flo, Tour & Anderson STAS/STAD, Victaulic series 786/787, Hays Fluid Controls.
3. Include one bellows type differential pressure meter kit that includes a six inch diameter gauge with 270° arc readout and having an accuracy of ±1% of full scale or better and suitable for the differential pressures of the valves supplied for this project, over-range protection, color coded hoses not less than ten feet in length with brass connectors suitable for connection to the low and high pressure connections on the balance valves, instrument valving so meter can be vented and drained, pressure and temperature rating at least equal to that of the valves. Provide meter and all accessories in a durable case with carrying handle.
4. Barton 247A, Midwest 809.
5. 2-1/2" and larger: Use butterfly valves as specified in this section along with a flow sensing device as specified in Section 23 05 15.

I. DRAIN VALVES:
1. Use 3/4 inch ball valve with threaded hose adapter except strainer blowdown valves to be the same size as the blowdown connection.
2. Hose connection caps shall be rated for 150 psig at 180 degrees Fahrenheit.

J. COMBINATION SHUT-OFF, CHECK, AND BALANCE VALVES:
   1. 2 inch and larger: Cast or ductile iron body, threaded or flanged or grooved end connections, stainless steel spring, bronze disc with EPDM seat, calibrated memory stop, backseating valve stem, inlet and outlet pressure tappings, capable of being repacked under full line pressure, and suitable for a minimum working pressure of 175 psig at 240°F when used in hot water heating systems.
   2. Armstrong Flo-Trex, Bell & Gossett Triple Duty, Taco Multi-Purpose Valve, Thrush-Amtrol Tri-Flow, Hays Fluid Controls.

K. WATER PRESSURE REDUCING VALVES:
   1. Brass or bronze body, diaphragm operated, with an integral anti-syphon check valve, inlet strainer, and adjustable reduced pressure range but pre-set for the scheduled pressure, 125 psig at 225°F.
   2. Bell & Gossett, Cash-Acme, or Watts.

L. WATER RELIEF VALVES:
   1. Iron or bronze body, direct pressure actuated, teflon seat, stainless steel stem and spring, suitable for 125 psig water working pressure at 240° F and ASME stamped, with Btu capacity and set point as scheduled.
   2. Bell & Gossett, Cash-Acme, Consolidated, Kunkle, Watts.

M. SELF CONTAINED CONTROL VALVES:
   1. Cast bronze or forged brass body, actuator with integral temperature sensor and adjustment-spring balanced bellows, stainless steel spindle riding against an O-ring within the packing gland, O-ring packing gland replaceable while the system is in operation with standard tools and without any need for isolation valves, suitable for 125 psig water working pressure at 240°F. Valves to return to the open position upon failure of temperature control unit.
   2. Bell & Gossett, Danfoss-Flomatic, Taco.

2.03 NATURAL GAS SYSTEMS

A. SHUT OFF VALVES:
   1. 2" and smaller: Ball valve, bronze body, threaded ends, chrome-plated bronze or stainless steel ball, full or conventional port, teflon seat, blowout-proof stem, two-piece construction, suitable for 150 psig working pressure, U.L. listed for use as natural gas shut-off.
   2. 2-1/2" through 4": Cast iron body, flanged ends, bronze bearings, electroless nickel plated cast iron plug with Hycar resilient plug seal, Buna-N stem seal packing, lever actuator, 175 psi W.O.G., U.L. listed for use as natural gas shut-off.
   3. 5" and larger: Cast iron body, flanged ends, stainless steel bearings, resilient faced plugs, totally enclosed hand wheel actuators, 175 psi W.O.G., U.L. listed for use as natural gas shut-off.
   4. DeZurik, Homestead, Rockwell, Walworth.

B. GAS PRESSURE REGULATORS:
   1. 2" and smaller: Cast iron body, aluminum spring and diaphragm, Nitrile diaphragm, threaded ends, 150 psi W.O.G., -20°F to 150°F.

2.04 GAUGE VALVES

A. Water Service: Use 1/4" ball valves.

2.05 STEM EXTENSIONS

A. Provide stem extensions when valve operators interfere with pipe insulation.

PART 3 – EXECUTION

3.01 GENERAL

A. Properly align piping before installation of valves in an upright position; operators installed below the valves will not be accepted.
B. Install valves in strict accordance with valve manufacturer's installation recommendations. Do not support weight of piping system on valve ends.
C. Install all temperature control valves.

D. Install all valves with the stem in the upright position. Valves may be installed with the stem in the horizontal position only where space limitations do not allow installation in an upright position or where large valves are provided with chain wheel operators. Where valves 2-1/2" and larger are located more than 12'-0" above mechanical room floors, install valve with stem in the horizontal position and provide a chain wheel operator. Valves installed with the stems down, will not be accepted.
E. Install stem extensions when shipped loose from valve.
F. Prior to flushing of piping systems, place all valves in the full-open position.

3.02 SHUT-OFF VALVES

A. Install shut-off valves on both sides of all equipment, on major piping loops, at each branch take-off from mains, at vertical risers, at strainers, and at each automatic valve for isolation or repair. All shut-off valves shall be located to allow proper access for operation for servicing.
B. WATER SYSTEM:
   1. Butterfly valves installed at the location of a flow sensing device are to have a memory stop.

3.03 BALANCING VALVES

A. Provide balancing valves for all equipment, on major piping loops, at vertical risers, at each major branch takeoff, and at the discharge of each pump. Provide balancing valve at all terminal devices. Refer to drawings and details for additional locations.

3.04 CALIBRATED BALANCING VALVES

A. Install where indicated on the drawings and details for balancing of hydronic systems. Retain the shipping container for use as removable insulation.

3.05 DRAIN VALVES

A. Provide drain valves for complete drainage of all systems. Locations of drain valves include low points of piping systems, equipment locations specified or detailed including reheat coils, other locations required for drainage of systems.

3.06 SAFETY RELIEF VALVES

A. Provide relief valves on pressure tanks, low pressure side of reducing valves, heat exchangers and expansion tanks.
B. Select system relief valve capacity so that it is greater than full heating capacity of system. Select equipment relief valve capacity to exceed rating of connected equipment.
C. Use air pressure to clean piping prior to installation of safety relief valves.
D. Install relief valves in locations indicated on drawings, downstream of all pressure reducing valves, and on all boilers.
E. Install valves in the vertical position, with drain holes, including those from dip pan elbows, piped to the nearest drain.
F. Inlet and outlet piping connecting to valves must be the same size as valve connections or larger. Where one line vents several relief valves, make crossectional area equal to sum of individual vent areas. Provide multiple relief valves where required by code.
G. Pipe discharge from water system relief valves to nearest drain. Verify routing of all drain pipe with owner before installation.

3.07 SPRING LOADED CHECK VALVES

A. Install a spring loaded check valve in each pump discharge line where two pumps operate in parallel and no combination shutoff, check and balancing valve is being used.

3.08 SWING CHECK VALVES

A. Provide swing check valves where specified, detailed, and at steam condensate lines where they rise at outlet of traps. In such cases, provide isolation valves to allow repair or replacement of check valve.

3.09 COMBINATION SHUT-OFF, CHECK, AND BALANCING VALVES

A. Contractor may use combination shut-off, check and balancing valves where separate shut-off valve, check valve, and balancing valve are specified or detailed in pump discharge piping.

3.10 PRESSURE REDUCING VALVES

A. Provide gate valve and strainer at inlet. Provide gate valve at outlet.
B. Install pressure gauges to indicate inlet and outlet pressure at each pressure reducing valve in accordance with Section 23 05 15 - Piping Specialties.
C. Use eccentric reducers at inlet and outlet of reducing valves where connections are not the same size as adjacent piping.

3.11 GAS PRESSURE REGULATORS

A. When the gas pressure regulator is equipped with a vent connection, run a connection size vent to the exterior of the building in accordance with codes. Use a larger size vent when required by the manufacturer's installation instructions.

END OF SECTION

SECTION 23 05 29
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Contractor shall provide all labor and materials for the hangers and supports for heating equipment and pipe to have a complete system in this specification section. Contractor shall provide all labor and materials for the hangers and supports for ventilating equipment and ductwork to have a complete system in this specification section.

1.02 SECTION INCLUDES

A. This section includes specifications for supports of all HVAC equipment and materials as well as piping system anchors. Included are the following topics:
   1. Pipe Hanger and Support Manufacturers
   2. Structural Supports
   3. Pipe Hangers and Supports
   4. Wood Structure Supports
   5. Beam Clamps
   6. Concrete Inserts
   7. Anchors
   8. Roof Mounted Supports
   9. Equipment Curbs
   10. Pipe Penetrations through Roof
   11. Corrosive Atmosphere Coatings

1.03 RELATED WORK

A. Applicable provisions of Division 1 shall govern work under this section.
B. Section 23 05 00 – Common Work Results for HVAC
C. Section 23 05 48 – Vibration and Seismic Controls for HVAC Piping and Equipment
D. Section 23 07 00 – HVAC Insulation

1.04 SUBMITTALS

A. Refer to Section 23 05 00 – Common Work Results for HVAC, Submittals. In addition to the general content specified under Section 23 05 00 – Common Work Results for HVAC, supply the following submittals:
   1. Pipe Hanger and Support Manufacturers
   2. Structural Supports
   3. Pipe Hangers and Supports
   4. Wood Structure Supports
   5. Beam Clamps
   6. Concrete Inserts
   7. Anchors
   8. Roof Mounted Supports
   9. Equipment Curbs
   10. Pipe Penetrations through Roof
   11. Corrosive Atmosphere Coatings
B. Schedule of all hanger and support devices indicating shields, attachment methods, and type of device for each pipe size and type of service.
C. All submittals are to comply with submission and content requirements specified in this specification.

1.05 REFERENCE STANDARDS

A. MSS SP-58 Pipe Hangers and Supports - Materials, Design and Manufacture.

1.06 QUALITY ASSURANCE

A. Refer to Division 1 for equals and substitutions.

1.07 DESIGN CRITERIA

A. Materials and application of pipe hangers and supports shall be in accordance with MSS Standard Practice SP-58 unless noted otherwise.
B. Piping connected to base mounted pumps, compressors, or other rotating or reciprocating equipment is to have vibration isolation supports for a distance of one hundred pipe diameters or three supports away from the equipment, whichever is greater. Standard pipe hangers/supports as specified in this section are required beyond the 100 pipe diameter/3 support distance.
C. Piping flexible connections and vibration isolation supports are required for piping connected to coils that are in a fan assembly where the entire assembly is mounted on vibration supports; the vibration isolation supports are required for a distance of one hundred pipe diameters or three supports away from the equipment, whichever is greater. Piping flexible connection and vibration isolation supports are not required when the fan section is separately and independently isolated by means of vibration supports and duct flexible connections. Standard pipe hangers/supports as specified in this section are required when there are no vibration isolation devices in the piping and beyond the 100 pipe diameter/3 support distance.
D. Piping supported by laying on the bottom chord of joists or trusses will not be accepted.
E. Fasteners depending on soft lead for holding power or requiring powder actuation will not be accepted.
F. Allow sufficient space between adjacent pipes and ducts for insulation, valve operation, routine maintenance, etc.

1.08 DESCRIPTION

A. Provide all supporting devices as required for the installation of mechanical equipment and materials. Supports and installation procedures are to conform to the latest requirements of the ANSI Code for pressure piping.
B. Do not hang any mechanical item directly from a metal deck or run piping so it rests on the bottom chord of any truss or joist.
C. Support apparatus and material under all conditions of operation, variations in installed and operating weight of equipment and piping, to prevent excess stress, and allow for proper expansion and contraction.
D. Protect insulation at all hanger points; see Related Work above.

PART 2 – PRODUCTS

2.01 PIPE HANGER AND SUPPORT MANUFACTURERS

A. Anvil, B-Line, Fee and Mason, Kindorf, Michigan Hanger, Unistrut. Anvil figure numbers are listed below; equivalent material by other manufacturers is acceptable.

2.02 STRUCTURAL SUPPORTS

A. Provide all supporting steel required for the installation of mechanical equipment and materials, whether or not it is specifically indicated or sized, including angles, channels, beams, etc. to suspend or floor support tanks and equipment.

2.03 PIPE HANGERS AND SUPPORTS

A. HANGERS FOR STEEL PIPE SIZES 1/2” THROUGH 2”:
   1. Carbon steel, adjustable, clevis, black finish. Anvil figure 65 or 260.
B. HANGERS FOR STEEL PIPE SIZES 2-1/2” AND OVER:
   1. Carbon steel, adjustable, clevis, black finish. Anvil figure 260.
   2. Adjustable steel yoke, cast iron roll, double hanger. Anvil figure 181.
C. MULTIPLE OR TRAPEZE HANGERS:
   1. Steel channels with welded spacers and hanger rods if calculations are submitted.
D. WALL SUPPORT:
   1. Welded steel bracket with hanger. B-Line 3068 Series, Anvil 194 Series.

2. Perforated epoxy painted finish, 16-12 gauge min., steel channels securely anchored to wall structure with interlocking, split type, bolt secured, galvanized pipe/tubing clamps. B-Line type S channel with B-2000 series clamps, Anvil type AS200 H with AS 1200 clamps. When copper piping is being supported, provide flexible elastomeric/thermoplastic isolation cushion material to completely encircle the piping and avoid contact with the channel or clamp, equal to B-Line B1999 Vibra Cushion or provide manufacturers clamp and cushion assemblies, B-Line BVT series, Anvil cushion clamp assembly.

E. VERTICAL RISER SUPPORT:
1. Carbon steel riser clamp, copper plated when used with copper pipe. Anvil figure 261 for steel pipe, figure CT121 for copper pipe.

F. FLOOR SUPPORT FOR PIPE SIZES THROUGH 4":
1. Cast iron adjustable pipe saddle, locknut nipple, floor flange, and concrete pier or steel support.

G. FLOOR SUPPORT FOR PIPE SIZES 5" AND OVER:
1. Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.

H. COPPER PIPE SUPPORT:
1. Carbon steel ring, adjustable, copper plated or polyvinylchloride coated.

I. INSULATION PROTECTION SHIELDS:
1. Galvanized carbon steel of not less than 18 gauge for use on insulated pipe 2-1/2 inch and larger. Minimum shield length is 12 inches. Equal to Anvil figure 167.

J. STEEL HANGER RODS:
1. Threaded both ends, threaded one end, or continuous threaded, black finish.
2. Size rods for individual hangers and trapeze support as indicated in the following schedule.
3. Total weight of equipment, including valves, fittings, pipe, pipe content, and insulation, are not to exceed the limits indicated.

Maximum Load (Lbs.) (650°F Maximum Temp.)	Rod Diameter (inches)
610	3/8
1130	1/2
1810	5/8
2710	3/4
3770	7/8
4960	1
8000	1-1/4

4. Provide rods complete with adjusting and lock nuts.

2.04 WOOD STRUCTURE SUPPORTS

A. Carbon steel pipe short strap for piping ½" through 2". Fastened with two No. 24 x 2 (minimum size) wood screws. Anvil Figure 262.

B. Carbon steel coach screw rods machine threaded on opposite ends, minimum 3/8" diameter. Anvil Figure 142.

C. Carbon steel side beam bracket with minimum 3/8" rod size and fastened with minimum ½" x 3" lag screws. Anvil Figure 207

2.05 BEAM CLAMPS

A. MSS SP-69 Type 23 malleable black iron clamp for attachment to beam flange to 0.62 inches thick for single threaded rods of 3/8, 1/2, and 5/8 inch diameter, for use with pipe sizes 4 inch and less. Furnish with a hardened steel cup point set screw. Anvil figure 86.

B. MSS SP-69 Type 28 or Type 29 forged steel jaw type clamp with a tie rod to lock clamp in place, suitable for rod sizes to 1-1/2 inch diameter but limited in application to pipe sizes 8 inch and less without prior approval. Anvil figure 228.

2.06 CONCRETE INSERTS

A. Carbon steel expansion anchors, vibration resistant, with ASTM B633 zinc plating. Use drill bit of same manufacturer as anchor. Approved manufacturers: Hilti, Rawl, Redhead.

2.07 ANCHORS

A. Use welding steel shapes, plates, and bars to secure piping to the structure.

2.08 ROOF MOUNTED SUPPORTS

A. All weather exposed roof mounted supports shall be constructed of galvanized steel.

B. HEIGHT OF SUPPORTS:

1. Based on the length of the longest main support member, the height of the support member above the roof deck to be as follows:

Length of Longest Support Member (inches)	Min. Height of Support Above Finished Roof
Up to 36”	18 inches
37” and Over	36 inches

C. SUPPORTS 18” OR LESS IN HEIGHT:

1. Prefabricated Metal Sleeper Curb:
   a. Constructed of not less than 18 gauge galvanized steel reinforced so it is structurally capable of supporting the intended load with no penetrations through the curb flashing, inside and outside corner sections that are mitered and continuously welded, filled with 3 pound density rigid fiberglass insulation, integral deck mounting flange, nominal two inch wood nailer, galvanized steel counter flashing with metal receiver cap Attach a galvanized steel channel track for securing pipe or duct roller and roller support. Do not use built-in metal base flashings or cants.

D. SUPPORTS 36” OR MORE IN HEIGHT:

1. Roof Support Stand/Equipment Roof Support Stand:
   a. Use galvanized structural steel members supported by pipe supports and use pipe or duct rollers fastened to the structural member. Pipe supports to be secured to the roof structure and sealed per pipe penetrations through roof specifications as specified in this section

2.09 EQUIPMENT CURBS

A. Prefabricated Metal Curb:

1. Constructed of not less than 18 gauge galvanized steel reinforced so it is structurally capable of supporting intended load with no penetrations through curb flashing, inside and outside corner sections that are mitered and continuously welded, filled with 3 pound density rigid fiberglass insulation, integral deck mounting flange, nominal two inch wood nailer, galvanized steel counter flashing. Do not use built-in metal base flashings or cants. Use 18 inch high equipment curbs where curb surrounds the perimeter of equipment and there is no roof exposed to weather.

2.10 PIPE PENETRATIONS THROUGH ROOF

A. Multiple Pipe Penetrations:

1. Refer to acceptable Equipment Curb types listed above for curb specifications. An 8” high (minimum) curb height is required. Coping cap shall be constructed from laminated acrylic clad thermoplastic (ABS) with graduated step boots to accommodate various size pipes, stainless steel fastening screws for cover, stainless steel band clamps for securing boots around the pipe, and stainless steel band clamp or mechanical locking seal for securing boots around ABS coping cap flanges.

B. Single Pipe Penetrations:

1. A stack flashing penetration may be utilized for single pipe penetrations through built up roofs and single ply membrane roofs. Utilize high temperature sealant for all high temperature applications. This includes but is not limited to flues.
2. A single pre-manufactured boot may be utilized for single pipe penetrations through single ply membrane roofs only.

2.11 CORROSIVE ATMOSPHERE COATINGS

A. Factory coat supports and anchors used in corrosive atmospheres with hot dip galvanizing after fabrication, ASTM A123, 1.5 ounces/square foot of surface, each side. Mechanical galvanize threaded products, ASTM B695 Class 150, 2.0 mil coating. Field cuts and damaged finishes to be field covered with zinc rich paint of comparable thickness to factory coating.

B. Corrosive atmospheres include the following locations:
   1. Exterior locations
   2. Sanitary pumping stations
   3. Food service/kitchen areas

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install supports to provide for free expansion of the piping and duct system. Support all piping from the structure using concrete inserts, beam clamps, ceiling plates, wall brackets, or floor stands. Fasten ceiling plates and wall brackets securely to the structure and test to demonstrate the adequacy of the fastening.
B. Piping shall be supported independently from ductwork and all other trades.
C. Where piping can be conveniently grouped to allow the use of trapeze type supports, use standard structural shapes for the supporting steel.
D. Perform all welding in accordance with standards of the American Welding Society. Clean surfaces of loose scale, rust, paint or other foreign matter and properly align before welding. Use wire brush on welds after welding. Welds shall show uniform section, smoothness of weld metal and freedom from porosity and clinkers. Where necessary to achieve smooth connections, joints shall be dressed smooth.

3.02 HANGER AND SUPPORT SPACING

A. Place a hanger within 12 inches of each horizontal elbow, valve, strainer, or similar piping specialty item.
B. Where several pipes can be installed in parallel and at the same elevation, provide multiple or trapeze hangers.
C. Support riser piping independently of connected horizontal piping.
D. Adjust hangers to obtain the slope specified in the piping section of this specification.
E. Space hangers for pipe as follows:

Pipe Material	Pipe Size	Max. Spacing
Steel	1/2" through 1-1/4"	6'-6"
Steel	1-1/2" through 6"	10'-0"
Steel	8" through 12"	14'-0"
Steel	14" and over	20'-0"
Copper	1/2" through 1-1/4"	5'-0"
Copper	1-1/2" and larger	8'-0"

3.03 VERTICAL RISER CLAMPS

A. Support vertical piping with clamps secured to the piping and resting on the building structure or secured to the building structure below at each floor.

3.04 ANCHORS

A. Install where indicated on the drawings and details. Where not specifically indicated, install anchors at ends of principal pipe runs and at intermediate points in pipe runs between expansion loops. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

3.05 ROOF MOUNTED SUPPORTS

A. Use for all pipe and ductwork on roof. Secure bottom of support flat on roof deck. Apply two coats of zinc rich paint to cut edges of all galvanized steel elements. Flashing and counter flashing by the General Contractor.

3.06 EQUIPMENT CURBS

A. Secure bottom of support flat on roof deck. Secure equipment to curb in accordance with equipment manufacturer's instructions. Flashing and counter flashing by the General Contractor.
B. Fill the entire void space with compressible fiberglass insulation.

3.07 PIPE PENETRATION THROUGH ROOF

A. Install at points where pipes penetrate roof. Install as shown on the drawings, as detailed and according to the manufacturer's installation instructions. Flashing and counterflashing by the General Contractor.

END OF SECTION

SECTION 23 05 48
VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Base Bid:
   1. Contractor provide vibration isolators and flexible connections for the following equipment specified and indicated on the drawings:
      a. Pumps
   2. Contractor provide vibration isolators and flexible connections for the following equipment specified and indicated on the drawings:
      a. Air Handling Unit Fans
      b. Fans
      c. Ductwork

1.02 SECTION INCLUDES

A. This section includes specifications for vibration isolation material for equipment, piping systems, and duct systems. Included are the following topics:
   1. Type A: Neoprene Pad
   2. Type B: Neoprene Mount
   3. Type C: Unhoused Spring with Neoprene
   4. Type D: Restrained Spring with Neoprene
   5. Type E: Spring Hanger with Neoprene
   6. Type F: Precompressed Spring Hanger with Neoprene
   7. Type G: Spring Hanger with Neoprene
   8. Type S: Steel Base
   9. Type T: Horizontal Thrust Restraint
   10. Flexible Piping Connections
   11. Curb Mounted Spring Rail

1.03 RELATED WORK

A. Applicable provisions of Division 1 govern work under this section.
B. Division 3 – Concrete
C. Section 23 05 00 – Common Work Results for HVAC
D. Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment
E. Section 23 11 00 – Facility Fuel Piping
F. Section 23 21 13 – Hydronic Piping
G. Section 23 21 23 – Hydronic Pumps
H. Section 23 34 00 – HVAC Fans
I. Section 23 33 00 – Air Duct Accessories

1.04 SUBMITTALS

A. Refer to Division 1, General Conditions, Submittals. At a minimum, provide submittals for the following items:
   1. Type A: Neoprene Pad
   2. Type B: Neoprene Mount
   3. Type C: Unhoused Spring with Neoprene
   4. Type D: Restrained Spring with Neoprene
   5. Type E: Spring Hanger with Neoprene
   6. Type F: Precompressed Spring Hanger with Neoprene
   7. Type G: Spring Hanger with Neoprene
   8. Type S: Steel Base
   9. Type T: Horizontal Thrust Restraint
   10. Flexible Piping Connections

11. Curb Mounted Spring Rail

B. Include isolator type, materials of construction, isolator free and operating heights, and isolation efficiency based on the lowest operating speed of the equipment supported.

1.05 QUALITY ASSURANCE

A. Refer to Division 1 for equals and substitutions.

1.06 DESIGN CRITERIA

A. Isolate all motor driven mechanical equipment from the building structure and from the systems which they serve to prevent equipment vibrations from being transmitted to the structure. Consider equipment weight distribution to provide uniform isolator deflections.

B. For equipment with variable speed capability, select vibration isolation devices based on lowest speed.

C. Provide flexible piping connections for all piping to rotating or reciprocating equipment mounted on vibration isolators except do not use flexible piping connectors on any type of gas piping or with inline pumps. Piping connected to a coil which is in an assembly mounted on vibration isolators is to have flexible piping connections and piping vibration hangers as specified below. Piping connected to a coil which is in an assembly where the fan is separately isolated by means of vibration isolators and duct flexible connections does not require flexible piping connectors or piping vibration hangers.

D. Credit will not be given for flexibility and vibration absorption characteristics of mechanical grooved pipe connections.

E. Coordinate the selection of devices with the isolator and equipment manufacturers. All isolation material used by contractor shall be supplied by one manufacturer.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Use materials that will retain their isolation characteristics for the life of the equipment served. Use industrial grade neoprene for elastomeric materials.

B. Treat all isolators to resist corrosion. For isolation devices exposed to the weather or used in high humidity areas, hot dip galvanize steel parts, apply a neoprene coating on all steel parts, or use stainless steel parts; include limit stops to resist wind.

C. Provide pairs of neoprene side snubbers or restraining springs where side torque or thrust may develop.

D. Use isolators with a ratio of lateral to vertical stiffness not less than 1.0 or greater than 2.0.

2.02 VIBRATION ISOLATOR MANUFACTURERS

A. Mason Industries, Amber/Booth Co., Vibration Mounting & Controls, Peabody Noise Control.

2.03 TYPE A: NEOPRENE PAD

A. Neoprene waffle pad, 40 durometer with 16 gauge shims between layers.

2.04 TYPE B: NEOPRENE MOUNT

A. Double deflection neoprene mount having a minimum static deflection of 0.35 inches. Cover all metal surfaces with neoprene to resist corrosion. Include friction pads on both top and bottom surfaces so mounts need not be bolted to the floor but include bolt holes for those areas where bolting is required. For equipment such as small vent sets and close coupled pumps, include steel rails for use between the isolator and the equipment to accommodate equipment overhang.

2.05 TYPE C: UNHOUSED SPRING WITH NEOPRENE

A. Combination freestanding, unhoused spring and neoprene with rib molded antifriction base. Include leveling bolts for securing to the equipment. Springs to be laterally stable under load and selected so they have an additional travel to solid equal to 50% of the rated deflection. Use height saving brackets when appropriate to the application.

2.06 TYPE D: RESTRAINED SPRING WITH NEOPRENE

A. Combination spring and neoprene with rib molded anti-friction base, but with a housing that includes vertical limit stops to prevent spring extension when weight is removed such that the installed and operating heights are the same. Maintain a minimum clearance of 1/2" around restraining bolts, and between the housing and the spring, so as not to interfere with the spring action. Design isolator so limit stops are out of contact during normal operation. Use height saving brackets when appropriate to the application.

2.07 TYPE E: SPRING HANGER WITH NEOPRENE

A. Vibration hanger with a steel spring and 0.3" deflection neoprene element in series. Use neoprene element molded with a rod isolation bushing that passes through the hanger box. Select spring diameters and size hanger box lower holes large enough to permit the hanger rod to swing through a 30 degree arc before contacting the hole and short circuiting the spring. Select springs so they have a minimum additional travel to solid equal to 50% of the rated deflection.

2.08 TYPE F: PRECOMPRESSED SPRING HANGER WITH NEOPRENE

A. A spring hanger (steel spring with 0.3" deflection neoprene element) but precompressed to the rated deflection to keep the piping or equipment at a fixed elevation during installation. Design hanger with a release mechanism to free the spring after the installation is complete and the hanger is subjected to its full load.

2.09 TYPE G: SPRING HANGER WITH NEOPRENE

A. Steel spring hanger located in a neoprene cup manufactured with a grommet to prevent short circuiting of the hanger rod. Neoprene cup to contain a steel washer designed to properly distribute the load on the neoprene and prevent its extrusion. Design spring diameter and size hanger box lower hole sufficiently large to permit the hanger rod to swing through a 30° arc before contacting the hole perimeter and short circuiting the spring. Select spring so it has a minimum additional travel to solid equal to 50% of the rated deflection. Provide hanger with an eye bolt on the spring end and provision to attach the housing to the flat iron duct straps.

2.10 TYPE S: STEEL BASE

A. Structural steel base, rectangular in shape for all equipment other than centrifugal refrigeration machines and pump bases which may be "T" or "L" shaped. Include support for suction and discharge base ells for split case pump bases. Use perimeter steel members with a minimum depth equal to 1/10 of the longest dimension of the base. Base depth need not exceed 14" provided that the deflection and misalignment is kept within acceptable limits as determined by the manufacturer. Use height saving brackets in all mounting locations to provide a base clearance of at least one inch above the floor or housekeeping pad.

2.11 TYPE T: HORIZONTAL THRUST RESTRAINT

A. Spring element in series with a neoprene pad as described for Type C mount with the same deflection as specified for the mounting or hanger. Design the assembly so the spring element is contained within a steel frame, so it can be preset for thrust at the factory and adjusted in the field for a maximum of 1/4" movement at start and stop. Include threaded rod and angle brackets for attachment to both equipment and ductwork or equipment and structure.

2.12 FLEXIBLE PIPING CONNECTIONS

A. Suitable for pressure, temperature, and fluid involved; minimum pressure rating for any system is 125 psig at the design temperature of the fluid. Use 12 inch minimum line length of flexible hose or length required to absorb 3/4" lateral movement, whichever is greater. When providing for future flexible connections, construct spool pieces to exact size.

B. Manufacturers:

1. Flexonics, Mason, Mercer Rubber, Metraflex, Proco.

C. Water and/or Pumped Condensate:
   1. Multiple plies of nylon tire cord fabric reinforced with an EPDM cover and liner. Do not use steel wire or rings as pressure reinforcement. Use threaded or soldered connections for sizes 2" and smaller and floating steel or ductile iron flanges for sizes 2-1/2" and larger; design the steel flange end so the steel flange is recessed to lock a steel wire bead ring in the raised face of the EPDM flange. Construct straight-through connections with twin spheres. Use control rods when recommended by the manufacturer.

D. Refrigerant:
   1. Seamless bronze corrugated flexible hose with bronze wire double braided cover and solder type copper tube ends with the entire assembly fabricated specifically for refrigerant duty.

2.13 CURB MOUNTED SPRING RAIL

A. Full-perimeter rail type isolator, spring components shall be 2" (51 mm) deflection, free-standing, un-housed, laterally stable steel springs. Springs shall have a lateral stiffness greater than 1.0 times the rated vertical stiffness and shall be designed for 50% overload to solid. Springs shall be color coded to indicate load capacity. Rails shall provide continuous support for the rooftop equipment and shall be designed to provide isolation against casing-radiated vibration in the rooftop equipment housing and structure-borne vibration from rotating and mechanical equipment in the rooftop package. Rail assembly shall consist of extruded aluminum top and bottom members connected by spring isolators and a continuous air- and water-tight seal. The seal shall be a beaded elastomeric material retained in a keyway along the top extrusion. The weather strip shall be sealed along the bottom with an aluminum fascia strip. Rail assemblies shall incorporate means for attachment to the building and the supported equipment and shall incorporate additional stiffening members, if necessary, to assure stability. Rails shall be fitted with wind restraint devices suitable for prevailing wind conditions that will not impose loads on the curb walls at 90 degrees to their long axis.

2.14 PERFORMANCE

A. Select vibration isolation devices as indicated below or to provide not less than 95% isolation efficiency, whichever is greater.

	---------- Floor Span or Column Spacing----------							
	--On Grade--		---20 Feet---		---30 Feet---		---40 Feet---	
TYPE OF EQUIPMENT	Iso. Type	Min. Static Defl. In.	Iso. Type	Min. Static Defl. In.	Iso. Type	Min. Static Defl. In.	Iso. Type	Min. Static Defl. In.
AIR-COOLED CONDENSING UNITS:	Bolt to pad		C	0.75	D	1.50	D	2.50

Centrifugal Blowers:

Suspended: Use Type E-T hangers with deflection from blower minimum deflection guide. Type T needed only when air thrust exceeds 10% of equipment weight.

Floor mounted: Use Type C-IB mount with deflection from blower minimum deflection guide.

Cabinet Fans and Fan Sections of Air Handling Units:

Suspended: Type E-T supports with deflection from blower minimum deflection guide. Type T needed only when air thrust exceeds 10% of equipment weight.

Floor mounted: Type B-T for 0.35" deflection, Type C-T for 0.75" deflections and Type C-S-T for deflections over 0.75" with deflection from blower minimum deflection guide.

Piping Connected to Rotating or Reciprocating Equipment:

Flexible piping connections and Type E or F hangers for a distance of 100 pipe diameters or a distance of three hangers away from the equipment, whichever is greater. Type F hangers shall be utilized for the first two upstream and downstream hangers. The Type E and/or Type F hangers must have the

same deflection as the hangers supporting the rotating or reciprocating equipment. Where piping is floor supported, the above requirement applies, but use Type C mounts instead of Type E or F hangers.

Vertical Pipe Risers:

DUCTWORK IN MECHANICAL EQUIPMENT ROOMS:

Use Type G hanger with .75" minimum deflection for all ducts with a cross sectional area greater than 2.0 square feet and, where either the air velocity is great than 3500 fpm or, the pressure class is 4" water column or higher.

2.15 BLOWER MINIMUM DEFLECTION GUIDE

		----------Required Deflection (Inches)----------			
		On	20'	30'	40'
A.	Fan Speed (RPM)	Grade	Floor Span	Floor Span	Floor Span
1.	175-224	0.35	3.50	4.50	4.50
2.	225-299	0.35	3.50	3.50	3.50
3.	300-374	0.35	2.50	2.50	3.50
4.	375-499	0.35	1.50	2.50	3.50
5.	500 and over	0.35	0.75	1.50	2.50

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install seismic and vibration isolation devices in accordance with the manufacturer's installation instructions. The isolation manufacturer and the manufacturer's authorized representative shall be responsible for:
   1. Selection of the proper size and type of isolation materials.
   2. Preparation of the submittal material required.
   3. Field inspection of the installation and, if, necessary, accompanying the Architect/Engineer on a field inspection of the installation.
   4. Written certification that the isolation is installed and operating as designed.

B. Unless otherwise noted on the equipment schedule, all mechanical equipment shall be mounted on vibration isolators to prevent the transmission of vibration and mechanically transmitted sound to the building structure. Vibration isolators shall be selected in accord with weight distribution of the isolated equipment to provide reasonably uniform deflection. Deflections shall be provided by the equipment manufacturer.

C. Bolt isolators to equipment and to supporting structure where isolator bolt holes are supplied.

D. Shim or adjust leveling screws to level equipment. Shims shall not interfere with isolator action.

E. Verify actual deflected height with design operating height and replace the isolator when they differ by 25% or more.

F. Correct interferences with the isolator action or report to the Architect/Engineer when interference is caused by another contractor.

G. Set steel and inertia bases for one inch clearance between concrete floor or housekeeping pad and base.

H. Do not allow installation practices to short circuit any isolation device.

I. Install flexible pipe connectors on pipes connected to equipment supported by vibration isolation. Install flexible piping connections on the equipment side of shut-off valves. Inspect piping layout; notify Architect/Engineer of additional anchors or expansion joints to adequately protect system. Provide inspection services by flexible pipe connector manufacturer's representative to certify installations are in accordance with manufacturer's recommendations. Install flexible pipe connectors at right angles to displacement.

J. For flexible pump connectors: shall be supported such that no weight will be supported by the connector. Piping shall be installed so that connector is not deformed by misalignment.

3.02 PACKAGED ROOFTOP AIR HANDLING UNITS AND CENTRIFUGAL FANS

A. Attach horizontal thrust restraints at the centerline of thrust and symmetrically on either side of the unit. Thrust restraints are not required when the fan section in not isolated from the remainder of the air handling unit by means of duct flexible connections.

3.03 ISOLATION DEVICES OUTDOORS OR IN HIGH HUMIDITY AREAS

A. Use only hot dip galvanized, stainless steel, or neoprene coated steel parts.

END OF SECTION

SECTION 23 05 93
TESTING, ADJUSTING AND BALANCING FOR HVAC

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Contractor provide:
   1. Personnel to accompany and assist air balancer during test, adjust and balancing of piping system(s).
   2. Have the temperature control manufacturer's representative set and adjust automatically operated devices to achieve specified sequence of operations.
   3. Have the temperature control manufacturer's representative accompany and assist Air Balancer during test, adjust and balancing of piping system(s).
   4. The balancing will be performed by a subcontractor retained by the Heating and Ventilating Contractors.

1.02 SECTION INCLUDES

A. This section includes air and water testing, adjusting and balancing for the entire project. Included are the following topics:
   1. Performing Testing, Adjusting and Balancing
   2. VAV Supply Duct System Static Pressure Setpoint
   3. Hydronic System Differential Pressure Control Setpoint
   4. Hydronic Systems

1.03 RELATED WORK

A. Applicable provisions of the General Conditions, Supplementary General Conditions and General Requirements in Division 1 govern work under this section.
B. Section 23 05 00 – Common Work Results for HVAC
C. Section 23 05 23 – General Duty Valves for HVAC Piping
D. Section 23 07 00 – HVAC Insulation
E. Section 23 09 14 – Pneumatic and Electric Instrumentation and Control Devices for HVAC
F. Section 23 09 23 – Direct Digital Control System for HVAC

1.04 SUBMITTALS

A. Refer to Division 1 for submittals. At a minimum, provide submittals for the following items:
   1. Testing, Adjusting and Balancing Report
B. Submit testing, adjusting and balancing reports bearing the seal and signature of the NEBB or AABC Certified Test and Balance Supervisor. The reports certify that the systems have been tested, adjusted and balanced in accordance with the referenced standards; are an accurate representation of how the systems have been installed and are operating; and are an accurate record of all final quantities measured to establish normal operating values of the systems.
C. Submission: Distribute electronic copies of the Report to the Contractor, the Project Coordinator, Architect/Engineer, and the owner.
D. Format: Cover page identifying project name, project number and descriptive title of contents. Divide the contents of the report into the below listed divisions:
   1. General Information
   2. Summary
   3. Air Systems
   4. Hydronic Systems
   5. Special Systems
E. Contents: Provide the following minimum information, forms and data:
   1. General Information: Inside cover sheet identifying Test and Balance Agency, Contractor, Architect, Engineer, Project Name and Project Number. Include addresses, contact names and telephone numbers. Also include a certification sheet containing the seal and signature of the Test and Balance Supervisor.

2. Summary: Provide summary sheet describing mechanical system deficiencies. Describe objectionable noise or drafts found during testing, adjusting and balancing. Provide recommendations for correcting unsatisfactory performances and indicate whether modifications required are within the scope of the contract, are design related or installation related. List instrumentation used during testing, adjusting and balancing procedures.
3. The remainder of the report to contain the appropriate standard NEBB or AABC forms for each respective item and system. Fill out forms completely. Where information cannot be obtained or is not applicable indicate same.
4. Instruments:
   a. Air balance instruments - Ranges shown are guides. Actual ranges used are subject to Architect/Engineer approval
   b. Velometer with probes and Pitot tube.
   c. Rotating vane anemometer.
   d. ASHRAE Standard Pitot tubes, stainless steel 5/16 outside diameter, lengths 18" and 36".
   e. Magnehelic Differential Air Pressure Gauges, 0 to 0.5", 0 to 1.0" and 0 to 5.0" water pressure ranges, each arranged as a portable unit for use with a standard Pitot tube.
   f. Combination inclined-vertical portable manometer, range 0 to 5.0" water.
   g. Portable type hook gage, range 0 to 12" water.
   h. Portable flexible U-tube manometer, magnetic mounting clips, range 0 to 18" water.
   i. Conical or pyramidal shaped hood.
5. System performance measuring instruments:
   a. Insertion thermometers, with graduations at 0.5° F.
   b. Sling Psychrometer.
   c. Tachometer, Centrifugal Type
   d. Revolution Counter
   e. Clamp-On Volt-Ammeter
   f. Recorders, Portable Type for temperature and humidity.

1.05 REFERENCE STANDARDS

A. AABC National Standards for Total System Balance, Sixth Edition, 2002.
B. ASHRAEASHRAE Handbook, 2007 HVAC Applications, Chapter 37, Testing Adjusting and Balancing.
C. NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems, Seventh Edition, 2005.

1.06 QUALITY ASSURANCE

A. Qualifications:
   1. An independent Firm specializing in Testing and Balancing of HVAC systems for a minimum of 3 years. A Firm not engaged in commerce of furnishing or providing equipment or material generally related to HVAC work other than that specifically related to installing Testing and Balancing components necessary for work in this section such as, but not limited to sheaves, pulleys, and balancing dampers.
   2. A certified member of AABC or certified by NEBB in the specific area of work performed. Maintain certification for the entire duration of the project. If certification of firm or any staff performing work is terminated or expires during the duration of the project, contact owner immediately.
   3. Technicians on this project must have satisfactorily completed work on a minimum of (3) three projects of at least 50% in size, and of similar complexity. Size is defined as the quantity of each specific individual item requiring testing and balancing such as, but not limited to, equipment, devices, terminal devices, and grilles and diffusers.
   4. Submit Qualifications of firm and project staff to the owner upon request.

1.07 DESCRIPTION

A. Contractor will separately contract with an independent test and balance agency to perform testing, adjusting, and balancing of air and hydronic systems required for this project. Work related to the testing, adjusting, and balancing that must be performed by installing mechanical contractor is specified in other section of these specifications.

B. Provide total mechanical systems testing, adjusting and balancing. Requirements include the balance of air and water distribution, adjustment of new and existing systems and equipment to provide design requirements indicated on the drawings, electrical measurement and verification of performance of all mechanical equipment, all in accordance with standards published by AABC or NEBB.

C. Test, adjust and balance all air and hydronic systems so that each room, piece of equipment or terminal device meets the design requirements indicated on the drawings and in the specifications.

D. Accomplish testing, adjusting and balancing work in a timely manner that allows partial occupancy of major buildings, occupancy of one building when the project involves many buildings, and completion of the entire project in the time stated in the Instruction to Bidders and in accordance with the completion schedule established for this project.

E. Verify that provisions are being made to accomplish the specified testing, adjusting and balancing work. If problems are found, handle as specified in Part 3 under Deficiencies.

1.08 PRE-INSTALLATION MEETING AND SCHEDULING

A. The test and balance agency is required to attend a pre-installation meeting with all other project contractors before the construction process is started. The test and balance agency shall give the Lead Contractor a detailed schedule of testing and balancing tasks for incorporation into the project schedule. Reference General Conditions Division 1 for Lead Contractor responsibilities for scheduling.

1.09 PRE-BALANCE CONFERENCE

A. 90 days prior to beginning testing, adjusting and balancing, schedule and conduct a conference with the owner and the mechanical system and temperature control system installing Contractors. Provide AE with a complete copy of the TAB plan for the project. The objective is final coordination and verification of system operation and readiness for testing, adjusting and balancing procedures and scheduling procedures with the above mentioned parties. Indicate work required to be completed prior to testing, adjusting, and balancing and identify the party responsible for completion of that work.

PART 2 – PRODUCTS

2.01 INSTRUMENTATION

A. Provide all required instrumentation to obtain proper measurements. Application of instruments and accuracy of instruments and measurements to be in accordance with the requirements of NEBB or AABC Standards and instrument manufacturer's specifications.

B. All instruments used for measurements shall be accurate, and calibration histories for each instrument to be available for examination by owner upon request. Calibration and maintenance of all instruments to be in accordance with the requirements of NEBB or AABC Standards.

C. Air balance instruments - Ranges shown are guides. Actual ranges used are subject to Architect/Engineer approval.
   1. Velometer with probes and Pitot tube.
   2. Rotating vane anemometer.
   3. ASHRAE Standard Pitot tubes, stainless steel 5/16 outside diameter, lengths 18” and 36”.
   4. Magnehelic Differential Air Pressure Gauges, 0 to 0.5”, 0 to 1.0” and 0 to 5.0” water pressure ranges, each arranged as a portable unit for use with a standard Pitot tube.
   5. Combination inclined-vertical portable manometer, range 0 to 5.0” water.
   6. Portable type hook gage, range 0 to 12” water.
   7. Portable flexible U-tube manometer, magnetic mounting clips, range 0 to 18” water.
   8. Conical or pyramidal shaped hood.

D. System performance measuring instruments:
   1. Insertion thermometers, with graduations at 0.5oF.
   2. Sling Psychrometer.

3. Tachometer, Centrifugal Type
4. Revolution Counter
5. Clamp-On Volt-Ammeter
6. Recorders, Portable Type for temperature and humidity.

PART 3 – EXECUTION

3.01 DAILY REPORTS

A. Submit to owner daily work activity reports for each day on which testing and balancing work is performed. Reports shall include description of day's activities and description of any system deficiencies.

3.02 PRELIMINARY PROCEDURES

A. Review preconstruction meeting report, applicable construction bulletins, applicable change orders and approved shop drawings of equipment, outlets/inlets and temperature controls.
B. Identify and list size, type and manufacturer of all equipment to be tested, including air terminals. Inspect all systems components for proper installation and operation. Use manufacturer's ratings for all equipment to make calculations except where field test shows ratings to be impractical. Verify that all instruments are accurately calibrated and maintained.
C. Check filters for cleanliness, dampers and valves for correct positioning, equipment for proper rotation and belt tension, temperature controls for completion of installation and hydronic systems for proper charge and purging of air.
D. Notify owner on a daily basis during balancing. Identify deficiencies preventing completion of testing, adjusting and balancing procedures. Do not proceed until systems are fully operational with all components necessary for complete testing, adjusting and balancing. Installing Contractors are required to provide personnel to check and verify system completion, readiness for balancing and assist Balancing Agency in providing specified system performance.

3.03 PERFORMING TESTING, ADJUSTING AND BALANCING

A. Perform testing, adjusting and balancing procedures on each system identified, in accordance with the detailed procedures outlined in the referenced standards except as may be modified below.
B. In areas containing ceilings, remove ceiling tile to accomplish balancing work; replace tile when work is complete and provide new tile for any tile that are damaged by this procedure. If the ceiling construction is such that access panels are required for the work of this section and the panels have not been provided, inform the owner.
C. Cut insulation, ductwork and piping for installation of test probes to the minimum extent necessary for adequate performance of procedures. Patch using materials identical to those removed, maintaining vapor barrier integrity and pressure rating of systems.
D. In air systems employing filters, blank off sufficient filter area to simulate a pressure drop that is midway between that of a clean filter and that of a dirty filter.
E. Measure and record system measurements at the fan and/or pump to determine total flow. Adjust equipment as required to yield specified total flow at terminals. Proceed taking measurements in mains and branches as required for final terminal balancing. Test and record motor full load amperes and current draw. Test and record system static pressure suction and discharge. Perform terminal balancing to specified flows balancing branch dampers, deflectors, extractors and valves prior to adjustment of terminals.
F. Check and record the following items at each heating and cooling coil:
   1. Inlet water and air temperature.
   2. Leaving water and air temperatures.
   3. Pressure drop of each coil.
   4. Pressure drop across bypass valve.
   5. Pump operating suction and discharge and final total dynamic head.
   6. All mechanical specifications of pumps.
   7. Actual/rated running amperage of pump motor.

G. Measure and record static air pressure conditions across fans, coils and filters. Indicate in report if cooling coil measurements were made on a wet or dry coil and if filter measurements were made on a clean or dirty filter. Spot check static air pressure conditions directly ahead of terminal units.
H. Adjust outside air, return air and relief air dampers for design conditions at both the minimum and maximum settings and record both sets of data. Balance modulating dampers at extreme conditions and record both sets of data. Balance variable air volume systems at maximum air flow rate, full cooling, and minimum flow rate, full heating; record all data.
I. Adjust register, grille and diffuser vanes and accessories to achieve proper air distribution patterns and uniform space temperatures free from objectionable noise and drafts within the capabilities of the installed system.
J. Provide fan and motor drive sheave adjustments necessary to obtain design performance. Provide drive changes specifically noted on drawings, if any. If work of this section indicates that any drive or motor is inadequate for the application, advise the engineer by giving the engineer properly sized motor/drive information (in accordance with manufacturers original service factor and installed motor horsepower requirements); Confirm any change will keep the duct/piping system within its design limitations with respect to speed of the device and pressure classification of the distribution system.
K. Areas or rooms designed to maintain positive, negative or balanced air pressures with respect to adjacent spaces, as indicated by the design air quantities, require special attention. Adjust fan drives, distribution dampers, terminals and controls to maintain indicated pressure relationship.
L. Final air system measurements to be within the following range of specified cfm:
   1. Fans 0% to +10%
   2. Supply grilles, registers, diffusers 0% to +10%
   3. Return/exhaust grilles, registers 0% to -10%
M. Final water system measurements must be within the following range of specified gpm:
   1. Heating flow rates 0% to -10%
   2. Cooling flow rates -5% to +5%
N. Contact the temperature control contractor for assistance in operation and adjustment of controls during testing, adjusting and balancing procedures. Cycle controls and verify proper operation and setpoints. Include in report description of temperature control operation and any deficiencies found.
O. Permanently mark equipment settings, including damper and valve positions, control settings, and similar devices allowing settings to be restored. Set and lock memory stops.
P. Leave systems in proper working order, replacing belt guards, closing access doors and electrical boxes, and restoring temperature controls to normal operating settings.
Q. Verify and record, in the T&B Report, "K" factors for all VAV air terminal devices and air flow stations. Provide minimum of two points of reference for calibration of air flow stations. Points of reference shall include minimum and maximum scheduled airflow quantities.
R. Coordinate air handling unit minimum outside air set points with the Temperature Control Contractor.

3.04 VAV SUPPLY DUCT SYSTEM STATIC PRESSURE SET POINT

A. For VAV supply, determine the minimum required duct static pressure at the DDC static pressure sensor location(s) needed to ensure that all VAV air terminals are operating at their design airflows with the most demanding VAV terminal wide open. Provide these static pressure numbers to the DDC temperature controls contractor and record them in the T&B report for each system.

3.05 HYDRONIC SYSTEM DIFFERENTIAL PRESSURE CONTROL SET POINT

A. For hydronic systems with variable speed pumping, determine the minimum required system differential pressure set point needed to ensure that all terminal devices are operating at their design water flows with the most demanding terminals device control valve wide open. Provide the differential control setting set point to the DDC temperature control contractor and record them in the T&B report for each system.

3.06 HYDRONIC SYSTEMS

A. Complete air balance must have been accomplished before water balance is begun. Open all valves to full position, including pump discharge valves, coil balancing fittings and return line balancing fittings. Close bypass valves.

B. For HVAC pumps 10 horsepower or less, valve throttling alone may be used for hydronic system balancing.
C. Check Pump Rotation.
D. Throttling of triple-duty valves shall not exceed 50% closed. Where additional throttling would be necessary to achieve the system design flow, the impellor shall be trimmed.
E. Verify Triple duty valve utilized on systems with Variable Frequency Drives are 100% open when balancing work is complete.
F. The pressure drop across triple duty valves shall not exceed 25 ft. w.g. Where additional throttling would be necessary to achieve the system design flow, the impellor shall be trimmed.
G. For HVAC pumps greater than 10 horsepower through 60 horsepower, trim the impellor where valve throttling will result in a draw that exceeds 3 horsepower.
H. horsepower draw that exceeds 5% of the pump motor horsepower rating.
I. Future fouling of an open piping system may be considered when determining impellor trim requirements.
J. Check expansion tanks to make sure they are not air bound and that the system is full of water. Check all air vents at high points of water systems to make sure they are installed properly and are operating freely. Make certain all air is removed from circulating system.
K. Verify butterfly valves utilized for hydronic system balancing are provided with position-lock operators (memory stops) in accordance with Section 23 05 23 – General Duty Valves for HVAC Piping. The adjustment and marking of lever-lock operators that use throttling notches will not be accepted. Lock all memory stops so the valves can be reopened to their balanced positions if they are used for isolation purposes.
L. Examine water in system to determine if it has been treated and is clean. Record your findings in report.

3.07 DEFICIENCIES

A. Division 23 00 00 contractor to correct any installation deficiencies found by the test and balance agency that were specified and/or shown on the Contract Documents to be performed as part of that division of work. Test and balance agency will notify the owner and engineer of these items and instructions will be issued to the Division 23 00 00 contractor for correction of the deficient work. All corrective work to be done at no cost to the owner. Retest mechanical systems, equipment, and devices once corrective work is complete as specified.

END OF SECTION

SECTION 23 07 00
HVAC INSULATION

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Base Bid:
   1. Contractor provide:
      a. Duct covering liner for all insulated ductwork.
      b. Duct covering insulation for all supply air ductwork, all outside air, all make-up air, all return air, all relief air, all exhaust air (within 30' of fan inlet and outlet), and all plenum ductwork.
   2. Contractor provide insulation for:
      a. Hot Water Systems
      b. Condensation Drain Lines
      c. Makeup Water Systems
      d. Refrigerant Suction Lines
   3. Contractor provide insulation of:
      a. Expansion Tank (Hot Water Systems)
      b. Air Separator (Hot Water Systems)
      c. Insulation of VAV Box Coils
      d. Insulation of Shop Fabricated Boxes for Wall Mounted Fan Coil Housings

1.02 SECTION INCLUDES

A. This section includes insulation specifications for heating, ventilating and air conditioning piping, ductwork and equipment. Included are the following topics:
   1. Insulation Types
      a. Flexible Fiberglass Insulation
      b. Rigid Fiberglass Insulation
      c. Semi-Rigid Fiberglass Insulation
      d. Calcium Silicate Insulation
      e. Elastomeric Insulation
      f. Polyolefin Insulation
      g. Phenolic Insulation
      h. Extruded Polystyrene Insulation
      i. Polyisocyanurate Insulation
      j. Cellular Glass Insulation
      k. Mineral Wool Insulation
      l. Fireproofing Insulation
      m. Fire-Stop Insulation
      n. Duct Liner Insulation
   2. Metal Covering and Jackets
      a. PVC Fitting Covers and Jackets (PFJ)
      b. All Service Jackets (ASJ)
      c. Foil Scrim All Service Jackets (FSJ)
      d. Protective Metal Jackets (PMJ)
      e. Self-Adhering Jackets (SAJ)
      f. Fabric Reinforced Mastic Jackets (FMJ)
      g. Vapor Retarding Jackets (VRJ)
      h. Vapor Retarding Tape
   3. Insulation Inserts and Pipe Shields
   4. Accessories

1.03 RELATED WORK

A. Applicable provisions of Division 1 govern work under this section.
B. Section 23 05 00 – Common Work Results for HVAC

C. Section 23 05 15 – Piping Specialties
D. Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment
E. Section 23 21 13 – Hydronic Piping
F. Section 23 31 00 – HVAC Ducts and Casings

1.04 SUBMITTALS

A. Refer to Division 1 for submittals. At a minimum, provide submittals for the following items:
   1. Insulation Types
      a. Flexible Fiberglass Insulation
      b. Rigid Fiberglass Insulation
      c. Semi-Rigid Fiberglass Insulation
      d. Calcium Silicate Insulation
      e. Elastomeric Insulation
      f. Polyolefin Insulation
      g. Phenolic Insulation
      h. Extruded Polystyrene Insulation
      i. Polyisocyanurate Insulation
      j. Cellular Glass Insulation
      k. Mineral Wool Insulation
      l. Fireproofing Insulation
      m. Fire-Stop Insulation
      n. Duct Liner Insulation
   2. Metal Covering and Jackets
      a. PVC Fitting Covers and Jackets (PFJ)
      b. All Service Jackets (ASJ)
      c. Foil Scrim All Service Jackets (FSJ)
      d. Self-Adhering Jackets (SAJ)
      e. Fabric Reinforced Mastic Jackets (FMJ)
      f. Vapor Retarding Jackets (VRJ)
      g. Vapor Retarding Tape
   3. Insulation Inserts and Pipe Shields
   4. Accessories
B. Submit a schedule of all insulating materials to be used on the project, including adhesives, fastening methods, fitting materials along with material safety data sheets and intended use of each material. Include manufacturer's technical data sheets indicating density, thermal characteristics, jacket type, and manufacturer's installation instructions.

1.05 REFERENCE STANDARDS

A. ASTM B209 Aluminum and Aluminum Alloy Sheet and Plate
B. ASTM C165 Test Method for Compressive Properties of Thermal Insulations
C. ASTM C177 Heat Flux and Thermal Transmission Properties
D. ASTM C195 Mineral Fiber Thermal Insulation Cement
E. ASTM C240 Cellular Glass Insulation Block
F. ASTM C302 Density of Preformed Pipe Insulation
G. ASTM C303 Density of Preformed Block Insulation
H. ASTM C355 Test Methods for Test for Water Vapor Transmission of Thick Materials
I. ASTM C449 Mineral Fiber Hydraulic Setting Thermal Insulation Cement
J. ASTM C518 Heat Flux and Thermal Transmission Properties
K. ASTM C533 Calcium Silicate Block and Pipe Thermal Insulation
L. ASTM C534 Preformed Flexible Elastomeric Thermal Insulation
M. ASTM C547 Mineral Fiber Preformed Pipe Insulation
N. ASTM C552 Cellular Glass Block and Pipe Thermal Insulation
O. ASTM C553 Mineral Fiber Blanket and Felt Insulation
P. ASTM C578 Preformed, Block Type Cellular Polystyrene Thermal Insulation
Q. ASTM C591 Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
R. ASTM C610 Expanded Perlite Block and Thermal Pipe Insulation

S.	ASTM C612	Mineral Fiber Block and Board Thermal Insulation
T.	ASTM C921	Properties of Jacketing Materials for Thermal Insulation
U.	ASTM C1136	Flexible Low Permeance Vapor Retarders for Thermal Insulation
V.	ASTM D412	Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension
W.	ASTM D1000	Methods for Pressure-Sensitive Adhesive-Coated Tapes Used for Electrical and Electronic Applications
X.	ASTM D1621	Standard Test Method for Compressive Properties of Rigid Cellular Plastics
Y.	ASTM D1622	Standard Test Method for Apparent Density of Rigid Cellular Plastics
Z.	ASTM D1940	Method of Test for Porosity of Rigid Cellular Plastics
AA.	ASTM D2126	Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging
BB.	ASTM D2240	Standard Test Method for Rubber Property—Durometer Hardness
CC.	ASTM E84	Surface Burning Characteristics of Building Materials
DD.	ASTM E814	Standard Test Method for Fire Tests of Penetration Firestop Systems
EE.	ASTM E2336	Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems
FF.	MICA	National Commercial & Industrial Insulation Standards
GG.	NFPA 225	Surface Burning Characteristics of Building Materials
HH.	UL 723	Surface Burning Characteristics of Building Materials

1.06 QUALITY ASSURANCE

A. Refer to Division 1 equals and substitutions
B. Label all insulating products delivered to the construction site with the manufacturer's name and description of materials.
C. Insulation systems shall be applied by experienced contractors. Within the past five (5) years, the contractor shall be able to document the successful completion of a minimum of three (3) projects of at least 50% of the size and similar scope of the work specified in this section.

1.07 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified in Section 23 05 00 – Common Work Results for HVAC.

1.08 DESCRIPTION

A. Furnish and install all insulating materials and accessories as specified or as required for a complete installation. The following types of insulation are specified in this section:
   1. Pipe Insulation
   2. Duct Insulation
   3. Equipment Insulation
B. Install all insulation in accordance with the latest edition of MICA (Midwest Insulation Contractors Association) Standard and manufacturer's installation instructions. Exceptions to these standards will only be accepted where specifically modified in these specifications, or where prior written approval has been obtained from the Owner.

1.09 DEFINITIONS

A. Concealed: shafts, furred spaces, space above finished ceilings, utility tunnels and crawl spaces. All other areas, including walk-through tunnels, shall be considered as exposed.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Do not store insulation materials on grade or where they are at risk of becoming wet. Do not install insulation products that have been exposed to water.
B. Protect installed insulation work with plastic sheeting to prevent water damage.
C. Delivery, Storage and Handling:
   1. Deliver field applied material to site in factory fabricated containers with manufacturer’s stamp or label showing fire hazard rating of products.
   2. Store in original wrappings and protect from weather and construction traffic.
   3. Protect against dirt, water, chemical and mechanical damage.
   4. Remove damaged insulation from project site, do not install.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Manufacturers: Armacell, Certainteed, Manson, Childers, Dow, Extol, Fibrex, Halstead, H.B. Fuller, Imcoa, Johns Manville, Knauf, Owens-Corning, Partek, Pittsburgh Corning, Rubatex, VentureTape.
B. Materials or accessories containing asbestos will not be accepted.
C. Use composite insulation systems (insulation, jackets, sealants, mastics, and adhesives) that have a flame spread rating of 25 or less and smoke developed rating of 50 or less when tested in accordance with ASTM E84, NFPA 255 or UL 723, with the following exceptions:
D. Pipe insulation which is not located in an air plenum may have a flame spread rating not over 25 and a smoke developed rating no higher than 450 when tested in accordance with UL 723 and ASTM E84.

2.02 INSULATION TYPES

A. Insulating materials shall be fire retardant, moisture and mildew resistant, and vermin proof. Insulation shall be suitable to receive jackets, adhesives and coatings as indicated.
B. Flexible Fiberglass Insulation: Minimum nominal density of 0.75 lbs. per cu. ft., and thermal conductivity of not more than 0.3 at 75 degrees F, rated for service to 250 degrees F. Installed R-Value of 6.0.
C. Rigid Fiberglass Insulation: Minimum nominal density of 3 lbs. per cu. ft., and thermal conductivity of not more than 0.23 at 75 degrees F, minimum compressive strength of 25 PSF at 10% deformation, rated for service to 450 degrees F.
D. Semi-Rigid Fiberglass Insulation: Minimum nominal density of 3 lbs. per cu. ft., thermal conductivity of not more than 0.28 at 75 degrees F, minimum compressive strength of 125 PSF at 10% deformation, rated for service to 450 degrees F. Insulation fibers perpendicular to jacket and scored for wrapping cylindrical surfaces.
E. Calcium Silicate Insulation: Rigid hydrous calcium silicate, ASTM C533, Type I, minimum dry density of 12.5 lbs. per cu. ft., thermal conductivity of not more than 0.44 at 300 degrees F, maximum water absorption of 90% by volume, minimum compressive strength 140 psi at 5% deformation, rated for service range of 0 degrees F to 1,200 degrees F. Material to be visually coded or marked to indicate it is asbestos free.
F. Elastomeric Insulation: Flexible closed cell, minimum nominal density of 5.5 lbs. per cu. ft., thermal conductivity of not more than 0.27 at 75 degrees F, minimum compressive strength of 4.5 psi at 25% deformation, maximum water vapor permeability of 0.17 perm inch, maximum water absorption of 6% by weight, rated for service range of -20 degrees F to 220 degrees F on piping and 180 degrees F where adhered to equipment.
G. Polyolefin Insulation: Flexible closed cell, minimum nominal density of 1.5 lbs. per cu. ft., thermal conductivity of not more than 0.24 at 75 degrees F, minimum compressive strength of 5 psi at 25% deformation, maximum water vapor permeability of 0.0 perm inch, maximum water absorption of 0% by weight and volume, rated for service range of -165 degrees F to 210 degrees F.
H. Phenolic Insulation: Rigid closed cell, minimum nominal density of 2.2 lbs. per cu. ft., thermal conductivity of not more than 0.13 at 75 degrees F, minimum compressive strength of 31 psi parallel and 18 psi perpendicular, maximum water vapor permeability 0.117 perm inch, maximum water absorption of .5% by volume, rated for service range of -290 degrees F to 250 degrees F.
I. Extruded Polystyrene Insulation: Rigid closed cell, minimum nominal density of 1.6 lbs. per cu. ft., thermal conductivity of not more than 0.285 at 75 degrees F, minimum compressive strength of 20 psi, maximum water vapor permeability of 1.5 perm inch, maximum water absorption of .5 % by volume, rated for service range of -290 degrees F to 165 degrees F.
J. Polyisocyanurate Insulation: Rigid closed cell polyisocyanurate, minimum nominal density of 2.0 lbs. per cu. ft., thermal conductivity of not more than 0.19 at 75 degrees F aged 180 days, minimum compressive strength of 24 psi parallel and 13 psi perpendicular, maximum water vapor permeability of 4 perm inch, maximum water absorption of 2% by volume, rated for service range of -290 degrees F to 300 degrees F.
K. Cellular Glass Insulation: Rigid closed cell, minimum nominal density of 8.5 lbs. per cu. ft., thermal conductivity of not more than 0.36 at 50 degrees F, minimum compressive strength of 100 psi, maximum

water vapor permeability of 0.0 perm inch, maximum water absorption of .2% by volume, rated for service range of -450 degrees F to 900 degrees F.

L. Mineral Wool Insulation:
   1. Rigid preformed mineral fiber, minimum nominal density of 8 lbs. per cu. ft., thermal conductivity of not more than 0.29 at 200 degrees F, minimum compressive strength of 3 psi, maximum wicking of 1%, maximum water adsorption of 1% by volume, rated for service of -120 degrees F to 1200 degrees F.
   2. Pipe insulation shall be preformed in two (2) half cylinder sections. Cut V-groove sheet insulation is not acceptable. Provide three (3) stainless steel bands for each section of insulation.

M. Fireproofing Insulation:
   1. Mineral fiber with nominal density of 8 lbs. per cu. ft., flame spread index of 25, fuel contribution index of 0, and smoke developed index of 0, thermal conductivity of not more than 0.23 at 75 degrees F, rated for service of -120 degrees F to 1200 degrees F. Use rigid or semi-rigid board for duct insulations.
   2. Foil-scrim-polyethylene vapor barrier jacket, factory applied to insulation, maximum permeance of .02 perms.

N. Fire-Stop Insulation:
   1. Noncombustible, non-asbestos, non-ceramic fiber, high temperature blanket or board fireproofing insulation, constructed of calcium silicate or calcium/magnesium/silica amorphous wool with 2-hour ASTM E814 “F” and “T” fire ratings, UL or equivalent third party listed, labeled and specifically evaluated for such purpose in accordance with ASTM E2336. Foil-scrim-polyethylene fiberglass reinforced factory applied jacket.

O. Duct Liner Insulation:
   1. Semi-rigid glass fiber blanket, 1 inch thick, 1.5 lbs./cu/ft. density, K value of 0.25 at 75 degrees F.
   2. Facing: NFPA 90A and 90B, fire resistant anti-bacterial neoprene coating or coating shall not allow moisture penetration into insulation.
   3. Temperature Range: 35 degrees F. to 180 degrees F.
   4. Air Velocity: Up to 4000 ft./min.
   5. Minimum Sound Absorption:

Frequency	1 inch
125	.26
250	.48
500	.70
1000	.90
2000	.93
4000	.80

Frequency	1 inch	1-1/2 inch	2 inch
Minimum NRC:	.70	.85	.95

   6. Fire Hazard Classification: 25 maximum flame spread; 25 maximum fuel contributed; 50 maximum smoke developed.
   7. Manufacturers:
      a. Knauf: Duct Liner M
      b. Schuller Linacoustic HP
      c. Owens-Corning Fiberglas: Aeroflex Duct Liner
   8. Accessories:
      a. Provide mechanical fasteners and similar accessories recommended by insulation manufacturer for applications indicated.
      b. Provide cements, waterproof adhesives, coatings, sealers, protective finishes and similar compounds recommended by insulation manufacturer to meet fire ratings and for applications indicated.

2.03 JACKETS

A. PVC Fitting Covers and Jackets (PFJ):

1. White PVC film, gloss finish one side, semi-gloss other side, FS LP-535D, Composition A, Type II, Grade GU. Ultraviolet inhibited indoor/outdoor grade to be used where exposed to high humidity, ultraviolet radiation, in kitchens or food processing areas or installed outdoors. Jacket thickness to be minimum .03" for piping 12" and smaller, .04" for piping 15" and larger.

B. All Service Jackets (ASJ): Heavy duty, fire retardant material with white kraft reinforced foil vapor barrier, factory applied to insulation with a self-sealing pressure sensitive adhesive lap, maximum permeance of .02 perms and minimum beach puncture resistance of 50 units.

C. Foil Scrim All Service Jackets (FSJ): Glass fiber reinforced foil kraft laminate, factory applied to insulation. Maximum permeance of .02 perms and minimum beach puncture resistance of 25 units.

D. Protective Metal Jackets (PMJ): .016 inch thick pebble finish aluminum or .010 inch thick stainless steel with safety edge.

E. Self-Adhering Jackets (SAJ):

1. 5-ply, self-adhering multiple laminated waterproofing material with reflective aluminum foil, high density polymer films and cold weather acrylic adhesive providing zero (0.0) permeability. Minimum 6 mils material thickness, 35lb puncture resistance when tested in accordance with ASTM D1000 and flame spread/smoke developed rating of 10/20 when tested in accordance with UL 723.
2. Vapor retarding tape shall be specifically designed and manufactured for use with the self-adhering jacket specified above. Tape shall be provided by the same manufacturer that provides jacketing. Vapor retarding tapes used with self-adhering jackets shall have a maximum permeance of 0.0 perms.

F. Fabric Reinforced Mastic Jackets (FMJ): Glass fiber reinforcing fabric imbedded in weather barrier mastic as per manufacturer's recommended procedure for 2 coat application.

G. Vapor Retarding Jackets (VRJ): Polyvinylidene chloride (PVDC) vapor retarding jacket material with minimum 6 mils material thickness and maximum permeance of 0.01 perms. Material shall not support the growth of mold or mildew. Dow Saran or equivalent.

H. Vapor Retarding Tape: Vapor retarding tape shall be specifically designed and manufactured for use with the vapor retarding jacket specified above. Tape shall be provided by the same manufacturer that provides jacketing. Vapor retarding tapes used with vapor retarding jackets shall have a maximum permeance of 0.01 perms.

2.04 INSULATION INSERTS AND PIPE SHIELDS

A. Manufacturers: B-Line, Pipe Shields, Value Engineered Products

B. Construct inserts with calcium silicate or polyisocyanurate (service temperatures below 300 degrees F only), minimum 140 psi compressive strength. Piping 12" and larger, supplement with high density 600 psi structural calcium silicate insert. Provide galvanized steel shield. Insert and shield to be minimum 180 degree coverage on bottom supported piping and full 360 degree coverage on clamped piping. On roller mounted piping and piping designed to slide on support, provide additional load distribution steel plate.

C. Where contractor proposes shop/site fabricated inserts and shields, submit schedule of materials, thicknesses, gauges and lengths for each pipe size to demonstrate equivalency to pre-engineered/premanufactured product described above. On low temperature systems, high density rigid polyisocyanurate may be substituted for calcium silicate provided insert and shield length and shield gauge are increased to compensate for lower insulation compressive strength.

D. Calcium Silicate Insulation: Rigid hydrous calcium silicate, ASTM C533, Type I, minimum dry density of 12.5 lbs. per cu. ft., thermal conductivity of not more than 0.44 at 300 degrees F, maximum water absorption of 90% by volume, minimum compressive strength 140 psi at 5% deformation, rated for service range of 0 degrees F to 1,200 degrees F. Material to be visually coded or marked to indicate it is asbestos free.

E. Polyisocyanurate Insulation: Rigid closed cell polyisocyanurate, minimum nominal density of 2.0 lbs. per cu. ft., thermal conductivity of not more than 0.19 at 75 degrees F aged 180 days, minimum compressive strength of 24 psi parallel and 13 psi perpendicular, maximum water vapor permeability of 4 perm inch, maximum water absorption of 2% by volume, rated for service range of -290 degrees F to 300 degrees F.

F. Precompressed 20# density molded fiberglass blocks, Hamfab or equal, of the same thickness as adjacent insulation may be substituted for calcium silicate inserts with one 1"x6" block for piping through 2-1/2"

and three 1"x6" blocks for piping through 4". Submit shield schedule to demonstrate equivalency to pre-engineered/premanufactured product described above.

G. Wood blocks will not be accepted.

2.05 ACCESSORIES

A. All products shall be compatible with surfaces and materials on which they are applied and be suitable for use at operating temperatures of the systems to which they are applied.
B. Adhesives, sealants, and protective finishes shall be as recommended by insulation manufacturer for applications specified.
C. Insulation bands to be 3/4 inch wide, constructed of aluminum or stainless steel. Minimum thickness to be .015 inch for aluminum and .010 inch for stainless steel.
D. Tack fasteners to be stainless steel ring grooved shank tacks.
E. Staples to be clinch style.
F. Insulating cement to be ANSI/ASTM C195, hydraulic setting mineral wool.
G. Finishing cement to be ASTM C449.
H. Fibrous glass or canvas fabric reinforcing shall have a minimum untreated weight of 6 oz./sq. yd.
I. Bedding compounds to be non-shrinking and permanently flexible.
J. Vapor barrier coatings to have maximum applied water vapor permeance of .05 perms.
K. Fungicidal water base coating (Foster 40-20 or equal) to be compatible with vapor barrier coating.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify that all piping, equipment, and ductwork are tested and approved prior to installing insulation. Do not insulate systems until testing and inspection procedures are completed.
B. Verify that all surfaces are clean, dry and without foreign material before applying insulation materials.

3.02 INSTALLATION

A. All materials shall be installed by skilled labor regularly engaged in this type of work. All materials shall be installed in strict accordance with manufacturer's recommendations, building codes, and industry standards. Do not install products when the ambient temperature or conditions are not consistent with the manufacturer's recommendations. Surfaces to be insulated must be clean and dry. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics and insulation cements. Maintain temperature during and after installation for minimum period of 24 hours.
B. Locate insulation and cover seams in the least visible location. All surface finishes shall be extended in such a manner as to protect all raw edges, ends and surfaces of insulation.
C. Install insulation with smooth and even surfaces. Poorly fitted joints or use of filler in voids will not be accepted. Provide neatly beveled and coated terminations at all nameplates, uninsulated fittings, or at other locations where insulation terminates.
D. Install fabric reinforcing without wrinkles. Overlap seams a minimum of 2 inches.
E. Use full length material (as delivered from manufacturer) wherever possible. Scrap piecing of insulation or pieces cut undersize and stretched to fit will not be accepted.
F. Existing or new insulation damaged and/or removed by the Contractor during remodeling work shall be repaired or replaced with new insulation as directed by the Owner.
G. All pipe and duct insulation shall be continuous through walls, ceiling or floor openings and through sleeves except where firestop or firesafing materials are required. Vapor barriers shall be maintained continuous through all penetrations.
H. Provide a continuous unbroken moisture vapor barrier on insulation applied to systems noted below. Attachments to cold surfaces shall be insulated and vapor sealed to prevent condensation.
I. Provide a complete vapor barrier for insulation on the following systems:
    1. Cold Water Make-Up
    2. Refrigerant
    3. Insulated Duct
    4. Equipment, ductwork or piping with a surface temperature below 65 degrees F

3.03 PROTECTIVE JACKET INSTALLATION

A. Self-Adhering Jackets (SAJ):
   1. Install according to manufacturer's recommendations. Cut allowing minimum 4" overlap on ends and 6" on longitudinal joints. Align parallel to surface. Remove release paper and press flat to surface to avoid wrinkles. Rub entire surface for full adhesion and sealing at joint overlaps. On exterior applications, provide a bead of compatible caulk along exposed edges.
   2. Piping with self-adhering (SAJ) jackets shall have elbows, fittings, valves and butt joints wrapped with 2 layers of vapor retarding tape. Piping with a PVC jacket (PFJ) installed over the self-adhering (SAJ) jacket may be provided with a single, lapped layer of vapor retarding tape for elbows, fittings and valves under the PVC jacket. Vapor retarding tape shall be compatible with the jacket material used.

B. Vapor Retarding Jackets (VRJ): Piping with vapor retarding (VRJ) jackets shall have elbows, fittings, valves and butt joints wrapped with 2 layers of vapor retarding tape. Piping with a PVC jacket (PFJ) installed over the vapor retarding (VRJ) jackets may be provided with a single, lapped layer of vapor retarding tape for elbows, fittings and valves under the PVC jacket. Vapor retarding tape shall be compatible with the jacket material used.

C. PVC Fitting Covers and Jackets (PFJ): Lap seams and joints a minimum of 2 inches and continuously seal PVC with welding solvent recommended by jacket manufacturer. Lap slip joint ends 4" without fasteners where required to absorb expansion and contraction. For sections where vapor barrier is not required, and jacket requires routine removal, tack fasteners may be used. Secure PVC fitting covers with tack fasteners. For systems requiring a vapor barrier, apply a 1-1/2" band of mastic over ends, throat, seams and penetrations.

D. Protective Metal Jacket (PMJ): Lap seams a minimum of 2 inches. Secure with metal bands for end to end joints, and rivets or sheet metal screws for longitudinal joints. Rivets, screws, and bands to be constructed of the same material as the jacket. Locate seams on bottom for exterior applications.

E. Fabric Reinforced Mastic Jackets (FMJ): Glass fiber fabric shall be fitted without wrinkles. Glass fiber fabric shall be sized immediately upon application with lagging adhesive and shall be capable of drying within 6 hrs. Apply adhesive and coating in accordance with manufacturer's recommendations. All seams shall overlap not less than 2".

3.04 PIPING, VALVE AND FITTING INSULATION

A. General:
   1. Install insulation with butt joints and longitudinal seams closed tightly. Provide minimum 2" lap on jacket seams and 2" tape on butt joints, firmly cemented with lap adhesive unless otherwise noted. Additionally, secure with staples along seams and butt joints. Coat staples, longitudinal and transverse seams with vapor barrier mastic on systems requiring vapor barrier.
   2. Install insulation continuous through pipe hangers and supports with hangers and supports on the exterior of insulation. Where a vapor barrier is not required or where roller hangers are not being used, hangers and supports may be attached directly to piping with insulation completely covering hanger or support and jacket sealed at support rod penetration. Where riser clamps are required to be attached directly to piping requiring vapor barrier, extend insulation and vapor barrier jacketing/coating around riser clamp.
   3. Where insulated piping is installed on hangers and supports, the insulation shall be installed continuous through the hangers and supports. High density inserts shall be provided as required to prevent the weight of the piping from crushing the insulation. Pipe shields are required at all support locations. The insulation shall not be notched or cut to accommodate the supporting channels.

B. Fully insulate all reheat coil piping, fittings and valves (with the exception of unions) up to coil connection to prevent condensation when coil is inactive during cooling season. Provide a vapor proof seal between the pipe insulation and the insulated coil casing.

C. Insulation Inserts and Pipe Shields:
   1. Provide pipe shields at all hanger and support locations. Rigid insulation inserts shall be installed between the pipe and the insulation shields. Quantity and placement of inserts shall be according to the manufacturer's installation instructions; however, the inserts shall be no less than 12" in length. Inserts shall be of equal thickness to the adjacent insulation and shall be vapor sealed as required for system.

2. Provide insulation inserts and pipe shields at all hanger and support locations. Inserts may be omitted on 3/4" and smaller copper piping provided 12" long 22 gauge pipe shields are used.

D. Fittings and Valves: Fittings, valves, unions, flanges, couplings and specialties may be insulated with factory molded or built up insulation of the same thickness as adjoining insulation. Where the ambient temperature exceeds 150 degrees F, cover insulation with fabric reinforcing and mastic. Where the ambient temperatures do not exceed 150 degrees, furnish and install PVC fitting covers.

E. Mineral Fiber: Secure each 3' section with three stainless steel bands or five 16 gauge stainless steel or annealed copper tie wires evenly spaced and at ends. Twist wire ends, snip off excess and turn ends over into insulation. Stagger joints where more than one layer is used.

F. Elastomeric and Polyolefin: Where practical, slip insulation on piping during pipe installation when pipe ends are open. Miter cut fittings allowing sufficient length to prevent stretching. Completely seal seams and joints for vapor tight installation. For elastomeric insulation, apply full bed of adhesive to both surfaces. For polyeolefin, seal factory preglued seams with roller and field seams and joints with full bed of hot melt polyolefin glue to both surfaces. Cover elastomeric insulation on systems operating below 40 degrees F with vapor barrier mastic.

G. Extruded Polystyrene and Polyisocyanurate:

1. Fittings, valves, unions, flanges, couplings and specialties shall be insulated with factory molded insulation of the same thickness as adjoining insulation. Secure insulation sections with two wraps of nylon filament tape 9"-12" on center. On single insulation layer systems and on the outer layer of double insulation layer systems, apply a thin coat of elastomeric joint sealant rated for system operating temperatures to all longitudinal and butt insulation joints covering entire face of joint. Allow sealant to fully cure before applying protective covering. For piping service below 0°F, use two layers of insulation with inner and outer butt and longitudinal joints staggered and offset 90 degrees. Where two layers of insulation are used, do not use sealant on the inner layer or adhere the inner layer to the outer layer. Apply vapor stop bead of joint sealant between pipe and insulation on both sides of valves, expansion/contraction joints, flanges, thermometers/gauges, attached vent and drain lines. Insulate attached non-circulated lines, control lines, vents, etc. for a minimum distance of 6" from pipe. Cover insulation with a protective jacket as specified below. Do not penetrate protective covering or insulation with mechanical fasteners.

3.05 PIPING PROTECTIVE JACKETS

A. In addition to the jackets specified in the pipe insulation schedule below the following protective jackets are required:

1. Provide a protective PVC jacket (PFJ) for the following insulated piping:
   a. Chilled water piping and valves in walk-thru tunnels and valve pits
2. Provide a protective PVC (PFJ) or Fabric Reinforced Mastic (FMJ) jacket for the following insulated piping: All piping within mechanical rooms
3. Provide a protective metal (PMJ) or self-adhering (SAJ) jacket for the following insulated piping:
   a. Exterior installed refrigeration piping
   b. Exposed chilled water, hot water low ambient condenser water, steam, and condensate piping

3.06 PIPE INSULATION SCHEDULE

A. Provide insulation on new and existing remodeled piping as indicated in the following schedule:

Service	**Insulation**	**Jacket**	**Insulation Thickness by Pipe Size**				
			≤ 1¼"	**1½"**	**2" to <4"**	**4" to 6"**	**8" and larger**
Heating Hot Water	Rigid Fiberglass	ASJ	1.5"	1.5"	2"	2"	2"
Note: On 1" or smaller hot water pipe runouts to terminal unit coils the insulation thickness may be reduced to ½" on both the supply and return pipes within 4ft of the coil but not on the distribution system side of the temperature control valve.							
Makeup Water	Polyiso./Polysty.	VRJ or SAJ	1.5"	1.5"	1.5"	1.5"	1.5"
Low Ambient Cold Water Piping	Rigid Fiberglass	ASJ	0.5"	0.5"	1"	1"	1"
Cooling Coil Condensate Drain	Rigid Fiberglass	ASJ	0.5"	0.5"	1"	1"	1"

B. The following piping and fittings are not to be insulated:

1. Hot water piping inside radiation, convector, or cabinet heater enclosures
2. Piping unions for systems not requiring a vapor barrier

C. For systems with fluid temperatures 65° F or less, furnish and install removable elastomeric insulation covers, plugs or caps for all mechanical equipment and devices that require access by balancing contractors or service and maintenance personnel. Examples include but are not limited to: flow sensing devices, circuit setters, manual ball valve air vents, drain valves, blowdown valves, pressure/temperature test plugs, grease fittings, pump bearing caps, equipment labels, etc. Covers shall be tight fitting to ensure a complete vapor barrier.

3.07 DUCT INSULATION

A. General:

1. Secure flexible duct insulation on sides and bottom of ductwork over 24" wide and all rigid duct insulation with weld pins. Space fasteners 18” on center or less as required to prevent sagging.
2. Secure rigid board insulation to ductwork with weld pins. Apply insulation with joints firmly butted as close as possible to the equipment surface. Pins shall be located a maximum of 3” from each edge and spaced no greater than 12” on center.
3. Install weld pins without damage to the interior galvanized surface of the duct. Clip pins back to washer and cover penetrations with tape of same material as jacket. Firmly butt seams and joints and cover with 4” tape of same material as jacket. Seal tape with plastic applicator and secure with staples. All joints, seams, edges and penetrations to be fully vapor sealed.
4. Stop and point insulation around access doors and damper operators to allow operation without disturbing insulation or jacket material.
5. External supply duct insulation is not required where ductwork contains continuous 1” acoustical liner. Provide 4” overlap of external insulation over ends of acoustically lined sections.
6. Where insulated ductwork is supported by trapeze hangers, the insulation shall be installed continuous through the hangers. Drop the supporting channels required to facilitate the installation of the insulation. Where rigid board or flexible insulation is specified, install high density inserts to prevent the weight of the ductwork from crushing the insulation.
7. Where insulated low temperature (below 45ºF) ductwork is supported by steel metal straps or wire ropes that are secured directly to the duct, the straps or ropes shall be completely covered with insulation and sealed to provide a complete vapor barrier.
8. Where insulated duct risers are supported by steel channels secured directly to the duct, extend the insulation and vapor barrier jacketing to encapsulate the support channels.
9. Where ductwork exposed to the weather is insulated, the top surface of the insulation shall be sloped a minimum of ¼” per foot to eliminate ponding and create positive drainage off of insulation.

3.08 DUCT INSULATION SCHEDULE

A. Provide duct insulation on new and existing remodeled ductwork in the following schedule:

Service	Insulation Type	Jacket	Insulation Thickness
Outside air ducts	Rigid Fiberglass	FSJ	2"
Mixed air ducts	Rigid Fiberglass	FSJ	2"
Exposed supply ducts*	Rigid Fiberglass	FSJ	2"
Concealed supply ducts	Flexible Fiberglass	FSJ	2"
Supply ductwork downstream of VAV boxes	Flexible Fiberglass		2”
Supply ductwork downstream of VAV boxes as indicated on drawings	Duct Liner Insulation		1-1/2”
Ductwork in unconditioned space	Rigid Fiberglass	FSJ	2"
Exhaust and relief ducts downstream of motorized backdraft dampers	Rigid Fiberglass	FSJ	2"
All ducts exposed to weather	Ext. Polystyrene	SAJ	3"
Slot Diffuser Plenums	Flexible Fiberglass	FSJ	1-1/2”
Exhaust ducts downstream of heat	Rigid Fiberglass	FSJ	2"
Louver blank-off panels	Rigid Fiberglass	FSJ	2”

* Exposed supply branch ducts located in the space they are serving do not require insulation. Exposed supply main ducts running through spaces they serve shall be insulated as exposed supply ducts scheduled above.

B. Duct Liner Insulation Installation:
   1. Acoustical Lining:
      a. See SMACNA, Duct Liner Application Standard for minimum standards.
      b. Apply to interior of ducts where indicated or scheduled.
      c. Secure to ductwork with 100% coverage adhesive and 12 gauge impale anchor tabs as recommended by SMACNA Figure #5, 1975 Edition.
      d. Continuously seal corner joints, tightly butted smooth joints no exposed edges; full coverage adhesive on all edges and butting surfaces; horizontal duct lining overlapping vertical section.
      e. Flat or longitudinal Joints: tightly butted, no exposed edges, full coverage adhesive at butting edges.
      f. Transverse Joints:
         1) Tight butt type, to preceding section of duct lining.
         2) Exposed edges: Coat with 100% saturated coat sprayed adhesive at shop.
         3) Edges tacky at time of installation, or re-coat in field.
         4) Make positive bond to preceding section duct lining.
         5) Protect edges from dirt and debris.
      g. Tightly seal tears, scuffs, breaks on air side with 100% continuous glass cloth sealing strips embedded in full coverage adhesive.
      h. Duct vanes not lined unless otherwise indicated.
      i. Insulation 1 inch thick unless otherwise indicated.
   2. Repair separation or cracking of insulation due to thermal movement or poor workmanship.
   3. Inspection of Duct Lining:
      a. At completion, Architect, Engineer may select at random inspection point in each type of system.
      b. At each inspection point, remove 1.0 sq. ft. or more of lining, including sheet metal duct for inspection.
      c. Inspection points based on 1 opening per 100 lin. ft. of total duct run.
   4. Inspection Items: Full adhesion and fastening methods; joints; holes in sheet metal at joints and fasteners.
   5. When one inspection point shows non-compliance, additional Architect/Engineer, and inspection repeated.
   6. When 20% of total number of inspection items, at all inspection points shows noncompliance, remove and replace entire duct required, correct all non-compliances.
   7. After inspections, repair all duct lining and sheet metal inspection holes by installing standard, lined, hinged type access doors.
   8. Repaint to equal new conditions.

3.09 EQUIPMENT INSULATION

A. General: Do not insulate over equipment access manholes, fittings, nameplates or ASME stamps. Bevel and seal insulation at these locations.

B. All equipment with fluid temperatures 50° F or less shall be insulated. If the equipment is not listed in the Equipment Insulation Schedule below, provide removable 1 inche thickness Elastomeric/Polyolefin on these mechanical equipment and devices. For mechanical equipment furnish and install insulation and removable elastomeric insulation covers, plugs or caps for all mechanical equipment and devices. Covers shall be tight fitting to ensure a complete vapor barrier.

C. Semi-Rigid Fiberglass: Apply insulation to equipment shells using weld pins, bonding adhesive, banded and wired in place. Fill all joints, seams and depressions with insulating cement to a smooth, even surface. Cover with reinforcing fabric and 2 coats of mastic (FMJ). Use vapor barrier mastic on systems requiring a vapor barrier.

D. Elastomeric/Polyolefin: Apply full cover coat of adhesive to surface to be insulated, insulation and edge butt joints. Place insulation with edge joints firmly butted pressing to surface for full adhesion. Seal seams and joints vapor tight.

3.10 EQUIPMENT INSULATION SCHEDULE

A. Provide equipment insulation as follows:

Equipment	Insulation	Jacket	Thickness Type
Reheat coil casing in exposed supply ducts	Rigid Fiberglass	FSJ	2"
Reheat coil casing in concealed supply ducts	Flexible Fiberglass	FSJ	2"
Hot Water Air separators	Semi-Rigid Fiberglass	ASJ/FMJ	1.5"

END OF SECTION

SECTION 23 09 14
PNEUMATIC AND ELECTRIC INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Unless noted otherwise, the Temperature Control Contractor shall provide all labor and materials for a complete system in this specification section.

1.02 SECTION INCLUDES

A. This section includes control system specifications for all HVAC work as well as related control for systems found in other specification sections. Included are the following topics:
   1. Control Dampers
   2. Control Valves
   3. Control System Instrumentation
   4. Electric/Electronic Thermostats
   5. Duct Smoke Detector and Fire Alarm Interface Modules
   6. Temperature Control Panels
   7. Temperature Sensors
   8. Humidity Sensors
   9. Differential Pressure Switches
   10. Current Status Switches
   11. Occupancy Sensor Wiring
   12. Carbon Dioxide (CO_2) Sensor
   13. Power Supplies

1.03 RELATED WORK

A. Applicable provisions of Division 1 govern work under this section.
B. Section 23 05 00 – Common Work Results for HVAC
C. Section 23 05 93 – Testing, Adjusting, and Balancing for HVAC - Coordination
D. Section 23 09 23 – Direct Digital Control System for HVAC
E. Section 23 09 93 – Sequence of Operations for HVAC Controls
F. Section 23 15 00 – Piping Specialties
G. Section 23 31 00 – HVAC Ducts
H. Section 23 33 00 – Ductwork Accessories - for control damper installation
I. Division 23 - HVAC - Equipment provided to be controlled or monitored
J. Division 26 – Electrical – Installation requirements & Equipment provided to be controlled or monitored
K. Division 28 - Electronic Safety and Security

1.04 SUBMITTALS

A. Refer Section 23 05 00 – Common Work Results for HVAC, Submittals. In addition to the general content specified under Section 23 05 00 – Common Work Results for HVAC, supply the following submittals:
   1. Control Dampers
   2. Control Valves
   3. Control System Instrumentation
   4. Electric/Electronic Thermostats
   5. Duct Smoke Detector and Fire Alarm Interface Modules
   6. Temperature Control Panels
   7. Temperature Sensors
   8. Humidity Sensors
   9. Differential Pressure Switches
   10. Current Status Switches
   11. Occupancy Sensor Wiring
   12. Carbon Dioxide (CO_2) Sensor
   13. Power Supplies

B. Include the following information:
   1. Manufacturer's data sheets indicating model number, pressure/temperature ratings, capacity, methods and materials of construction, installation instructions, and recommended maintenance. General catalog sheets showing a series of the same device is not acceptable unless the specific model is clearly marked.
   2. Schematic flow diagrams of systems showing fans, pumps, coils, dampers, valves, and other control devices. Label each device with setting or adjustable range of control. Indicate all wiring, clearly, differentiating between factory and field installed wiring. Wiring should be shown in schematics that detail contact states, relay references, etc. Diagrammatic representations of devices alone are not acceptable.
   3. Details of construction, layout, and location of each temperature control panel within the building, including instruments location in panel and labeling. Also include on drawings location of mechanical equipment controlled (room number), horsepower and flow of motorized equipment (when this data is available on plans), locations of all remote sensors and control devices (either by room number or column lines).
   4. Schedule of control dampers indicating size, leakage rating, arrangement, pressure drop at design airflow, and number and size of operators required.
   5. Schedule of control valves indicating system in which the device is to be used, rated capacity, flow coefficient, flow required by device served, actual pressure drop at design flow, size of operator required, close-off pressure, and locations where valves are to be installed.
   6. A complete description of each control sequence for equipment that is not controlled by direct digital controls. Direct digital controlled equipment control sequences will be provided by the DDC control contractor.

C. Prior to request for final payment, submit record documents which accurately record actual location of control components including panels, thermostats, wiring, and sensors. Incorporate changes required during installation and start-up.

1.05 REFERENCE STANDARDS

A.	ANSI B16.22	Wrought Copper and Wrought Copper Alloy Solder Joint Pressure Fittings
B.	ANSI/ASTM B32	Specification for Solder Metal
C.	ASTM B75	Seamless Copper Tube
D.	ASTM D1693	Environmental Stress-Cracking of Ethylene Plastics
E.	ASTM D 635	Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position
F.	UL 94	Tests for Flammability of Plastic Materials for Parts in Devices and Appliances
G.	AMCA 500-D	Laboratory Method of Testing Dampers for Rating
H.	ASHRAE Guideline 16-2010	Selecting Outdoor, Return and Relief Dampers for Air-Side Economizer Systems

1.06 QUALITY ASSURANCE

A. Manufacturers: Installing contractor must be a manufacturer's branch office or an authorized representative of a Direct Digital Control (DDC) equipment manufacturer that provides engineering and commissioning of the DDC equipment. Submit written confirmation of such authorization from the manufacturer. Indicate in letter of authorization that installing contractor has successfully completed all necessary training required for engineering, installation, and commissioning of equipment and systems and that such authorization has been in effect for a period of not less than three years. DDC equipment may or may not be required to be installed by this contractor as part of the project, but the intent of this quality assurance specification is to ensure that the installing contractor has the capabilities to engineer, install, and commission the field devices supplied under this section for temperature control.

1.07 DESIGN CRITERIA

A. Size all control apparatus to properly supply and/or operate and control the apparatus served. For example; damper and valve actuators shall have sufficient power to operate their respective valve or damper from 0 to 100% under load smoothly, without jerking or hysteresis.
B. Provide control devices subject to corrosive environments with corrosion protection or construct them so they are suitable for use in such an environment.
C. Provide devices exposed to outside ambient conditions with weather protection or construct them so they are suitable for outdoor installation.
D. Use only UL labeled products that comply with NEMA Standards. Electrical components and installation to meet all requirements of the electrical sections (Division 26) of project specifications.

1.08 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified in Section 23 05 00 – Common Work Results for HVAC.
B. In addition to the general content specified Section 23 05 00 – Common Work Results for HVAC, supply the following additional documentation:
   1. Lubrication instructions, including list/frequency of lubrication
   2. List indicating types and grades of oil and/or grease, packing materials, normal and abnormal tolerances for devices, and method of equipment adjustment
   3. Table noting full load power factor, service factor, NEMA design designation, insulation class and frame type for each motor provided
   4. A complete set of record drawings

1.09 DELIVERY, STORAGE AND HANDLING

A. Provide factory shipping cartons for each piece of equipment and control device. This contractor is responsible for storage of equipment and materials inside and protected from the weather.

1.10 SYSTEM DESCRIPTION

A. System is to use direct digital control with electric actuation for air handling units; direct digital control with electric actuation for room temperature, room humidity, and terminal airflow control; and electric control for other terminal units.

1.11 DEMOLITION

A. Where existing control devices, piping, or wiring are discontinued from use, remove and turn over to owner. If owner does not want them remove from premises. Remove any previously abandoned control devices in a similar manner.

PART 2 – PRODUCTS

2.01 CONTROL DAMPERS

A. Provide control dampers shown on the plans and as required to perform the specified functions. Dampers shall be rated for velocities that will be encountered at maximum system design and rated for pressure equal to or greater than the ductwork pressure class of the ductwork where the damper is installed, as specified in Section 23 31 00 – HVAC Ducts and Casings.
B. Use only factory fabricated dampers with mechanically captured replaceable resilient blade seals, stainless steel jamb seals and with entire assembly suitable for the maximum temperature and air velocities encountered in the system.
C. All dampers in aluminum ductwork shall be constructed of stainless steel or aluminum.
D. Dampers in galvanized ductwork shall be constructed of galvanized steel and/or aluminum.
E. All dampers, unless otherwise specified, to be rated at a minimum of 180º F working temperature. Leakage testing shall be certified to be based on latest edition of AMCA Standard 500-D and all dampers, unless otherwise specified, shall have leakage ratings as follows:

Damper Class	Differential Pressure	Leakage
Class IA	1” w.g.	$\leq$3 CFM/ft^2
Class I	4” w.g.	$\leq$8 CFM/ft^2

F. Leakage rate dampers for differential pressures that they will encounter at maximum system design pressures.
G. Steel framed dampers: Nailor models 2010 & 2020; Greenheck models VCD-33 & VCD-42; Johnson Controls model V-1330; Ruskin Models CD60 & CD40.
H. Aluminum frame and blade dampers: Nailor models 2010EAF & 202EAF; Greenheck model VCD-43; Ruskin model CD50; Arrow model AFD-20.
I. Dampers used for directed mixing of airstreams, i.e. outside air and return air, to be parallel blade type and sized for an air velocity of 1800 to 2000 fpm with the damper blades shall be arranged so that the air streams are directed at one another to facilitate mixing. Dampers used for throttling or modulating applications other than air stream mixing to be opposed blade type. Two position dampers may be parallel or opposed blade type.
J. Dampers used for isolation on the discharge of centrifugal fans shall have damper blades perpendicular to the fan shaft to minimize system effect. Dampers mounted with blades vertically shall be designed for vertical blade orientation.
K. Dampers for applications to have frames of not less than 16 gauge galvanized steel or 12 gauge extruded aluminum. Blades to be two-ply steel airfoil of not less than 2 x 20 gauge galvanized steel (14 gauge equivalent) or extruded aluminum airfoil, with stainless steel, acetal, Celcon, bronze, or nylon bearings. Maximum allowable blade width is 8 inches. Use plated steel linkage hardware.
L. Maximum damper width is 48 inches; where required width exceeds 48 inches, use multiple damper sections. Inside frame free area shall be a minimum of 90% of total inside duct area.
M. Size operators for smooth and positive operation of devices served, and with sufficient torque capacity to provide tight shutoff against system temperatures and pressure encountered.
   1. For electric modulating actuation, use fully proportional actuators with zero and span adjustments.
   2. For terminal unit actuators, stepping motors may be used and zero and span is not required.
   3. For two-position electric actuation use 24 VAC for DDC controlled actuators, 120 VAC actuators may be used for hardwire interlocking.
N. Refer to control diagram/point chart on drawings for specific type of input signal required. Actuator stroke times shall match the requirements of the DDC controllers provided under Section 23 09 23 – Direct Digital Control System for HVAC and/or the specific system requirements for proper operation. All electric actuators will be provided with overload protection to prevent motor from damage when stall condition is encountered. Equip operators with spring return or stored energy fail-safe return for applications involving fire, freeze protection, moisture protection or specified normally open/closed operation. Provide damper end switches with form "C" contacts where control sequences require damper position indication. End switches shall not contain mercury.
O. All power required for electric actuation shall be provided by this contractor if it is not able to be directly provided from the DDC controller.
P. Provide operators with linkages and brackets for mounting on device served.
Q. All outdoor air, return air, and relief air dampers to be sized in accordance with the ASHRAE Guideline 16-2010.

2.02 CONTROL VALVES

A. Provide all control valves as shown on the plans/details and as required to perform functions specified. Spring ranges must be selected to prevent overlap of operation and simultaneous heating and cooling.
B. Valve Selection Criteria:
   1. Submit engineering calculations for sizing modulating control valves unless valves are scheduled. Control valves serving terminal devices may be sized based on flow ranges for each pump system.
   2. Calculations for sizing modulating valves shall be based on actual characteristics of equipment and system in which valves are installed. Valve calculations shall include information such as pump head or available pressure
   3. Temperature Control Contractor is responsible for obtaining adequate system information necessary for sizing.
   4. Select control valves to meet their intended service without cavitation. Provide cavitation calculations for modulating globe control valves over 250°F and all modulating butterfly valves over 60°F.
   5. Select control valves and actuators for 100% shut-off against system's maximum differential pressure.

6. Provide valve trim to limit audible sound levels to 85 dBA or less when measured at 5 feet.

C. Size operators to allow smooth and positive operation of devices served and to provide sufficient torque capacity for tight shutoff against system temperatures and pressure encountered.
   1. For electric modulating actuation, use fully proportional actuators with 0-10VDC inputs and zero and span adjustments unless specified otherwise in the chart below.

D. If TriState with feedback is specified, valve position shall be fed back to the controller and controller shall position valve based on this feedback.

E. For two-position electric actuation use 24 VAC for DDC controlled actuators, 120 VAC actuators may be used for hardwire interlocking.

F. Electric actuators, for applications other than terminal units, shall be provided with a manual override capability. All electric actuators shall be provided with a visible position indicator.

G. All power required for electric actuation shall be provided by this contractor if it is not able to be directly provided from the DDC controller.

H. Provide operators that are full proportioning or two-position, as required for specified sequence of operation. Provide spring-return for applications involving fire, freeze protection, moisture protection or specified normally open/closed operation. Valves shall move to their fail positions on loss of electrical power or air pressure to the actuator.

I. Two-position and shut-off valves shall be sized for a maximum pressure drop of 2 PSI at design flow and shall be a minimum of line size.

J. Provide operators with linkages and brackets for mounting on device served.

K. All valves unless specifically noted on the plans or indicated below shall be globe style valves.

VALVE SERVING	**TYPE** Globe Butterfly (BF) Ball Press Independent Ball (PI Ball)	**SIGNAL** 0-10 VDC 2-Position Elect Pneumatic (Pneu)	**SPRING RETURN** REQUIRED Yes No	**FAIL POSITION** Open (thru Coil) Closed (bypass Coil) Last Position
Reheat Coil	Globe or Ball	0-10 VDC or TriState w/feedback	No	Last Position
Radiation w/Reheat	Globe or Ball	TriState	No	Last Position
Standalone Radiation	Globe or Ball	0 DC	No	Last Position
CUH and UH	Globe or Ball	2-Pos Elect	Yes	Open

L. See plan details, notes, and schedules for where two-way and three-way valves should be used.
   1. Equivalent Cv butterfly valves may be used where 3” and larger globe valves would be required.

M. WATER SYSTEMS:
   1. Use equal percentage valves for two-way control valves; size for a pressure drop not less than 4 psi or more than 6 psi. Select control valves based upon pressure drop calculations and Cv values at 100% stroke. Note: For low flows, the required minimum Cv size will result in lower pressure drop than 4 psi.
   2. Select control valves based upon pressure drop calculations and Cv values at 100% stroke
   3. Use three-way valves sized for a maximum pressure drop of 5 psi and that have linear characteristics so that the valve pressure drop remains constant regardless of the valve position.
   4. Globe valves 2" and smaller: Cast bronze or forged brass body, brass plug and brass or stainless steel seat, stainless steel stem, screwed ends, suitable for use on water systems at 150 psig and 240° F. Seat leakage with actuator supplied will meet ANSI class IV leakage (0.01%). Only the following globe valve body styles will be acceptable for terminal unit control: Siemens Powermite 599 VF Series (599 VE Series Zone Valves are not acceptable), Invensys VB7200 Series, Johnson Controls VG7000 Series, and Honeywell V5011/V5013 Series. Minimum size for globe valves shall be 1.5 Cv.
   5. Characterized Ball Valves: The following manufacturers are acceptable: Honeywell, Belimo, Johnson Controls, KMC Controls, Yamatake. For use on terminal units only where specified above. Forged brass or bronze body, stainless steel shaft and ball, reinforced Teflon or PTFE ball seals, double O-ring stem seals, characterized disk, maximum of ANSI Class IV (0.01%) leakage, suitable for use on water systems at 150 psig and 212° F. Minimum size for ball valves shall be 1.0 Cv.

N. Instrumentation Valves: Unless otherwise noted, instrumentation shut-off valves for isolation of gauges, switches, transmitters, etc., shall be as follows:
   1. Water systems: globe-type valves
   2. Ductwork, air handling unit or air terminal device penetrations: ball or plug-type valves
O. Self-Contained Temperature Regulating Valves:
   1. Valve body shall be 150 psi bronze globe type with threaded connections for 2" and smaller and 125 psi cast iron with flanged connections for 2-1/2" and larger. Actuators shall be diaphragm type with remote liquid filled bulb with 6 feet of armored tubing, unless otherwise indicated.
   2. Size valves for maximum bandwidth of 20°F. Manufacturers: ITT Hoffman, Honeywell, Johnson Controls (Penn), Siebe Environmental Controls (Robertshaw), Trerice, Watson McDaniel.
P. Damper and Valve Actuators:
   1. Analog Electronic: Actuators shall be hydraulic or electric motor/gear drives that respond proportionally to analog voltage or current input. Stroke time for major equipment shall be 90 seconds or less for 90° rotation. Stroke time for terminal equipment shall be compatible with associated local controller, but no more than 6 minutes. Provide spring return feature for fail open or closed positions, as required by control sequence, for critical applications such as outside, return, or exhaust dampers, heating and cooling coils on major air handling units, humidifiers, heat exchangers, flow control for major equipment items such as chillers, cooling towers, boilers, etc. Provide position feedback potentiometers connected to controller for closed loop control on major equipment analog control loops. Actuators for terminal heating/cooling equipment do not require spring return feature. Manufacturers: Belimo, Honeywell, Johnson Controls, Siemens Building Technologies or Invensys Building Systems.
   2. Discrete Two-Position Electric: Actuators shall be hydraulic or electric motor/gear drives for two-position control. Stroke time shall be 90 seconds or less for 90° rotation. Provide spring return feature for fail open or closed positions as required by control sequence. Manufacturers: Belimo, Honeywell, Johnson Controls, Siemens Building Technologies or Invensys Building Systems.

2.03 CONTROL SYSTEM INSTRUMENTATION

A. Manufacturers: Averaging Type - Johnson Controls; Bulb Type - Johnson Controls, Ashcroft, Marshall, Weksler
B. Pipe Thermometers: 9 inch stem type with an adjustable swivel mount. Scale graduations of 2°F and mid-range accuracy of ±1°F. Install thermometers in separable brass wells filled with conductive fluid. Thermometer temperature range shall not be more than twice the expected temperature range at installed location.
C. Remote Bulb Thermometers: 3 inch or larger dial type with recalibration screw on face. Accuracy within 1% of scale range. Thermometers with sensing elements in air ducts with an area of above 6 square feet to have averaging liquid or gas filled capillary sensing elements. Provide separable wells for all pipeline applications. Thermometer temperature range shall not be more than twice the expected temperature range at installed location.

2.04 ELECTRIC/ELECTRONIC THERMOSTATS

A. Electric Thermostats: For single setpoint applications, provide line or low voltage electric type suitable for heating or heating and cooling as required. Provide the required number of heating and/or cooling stages required for the application. For line voltage ventilation applications utilizing fans and where otherwise specified in the sequence of operations, provide an integral manual On/Off/Auto selector switch. Minimum contact rating shall be equal to electrical load of device being controlled.
B. Low Voltage Electronic Thermostats:
   1. Manufacturers: Honeywell, Johnson Controls, Viconics.
   2. Where unoccupied setpoints are specified, provide electronic programmable type with seven day setup/setback scheduling with a minimum of two occupied and unoccupied schedules per day through keypad entry on front of unit. For heating and cooling applications, provide automatic heating/cooling switchover. For applications that control fans, provide fan override switch. For ventilation or packaged economizer applications provide a dry contact for ventilation damper or economizer initiation. For thermostat control of economizer, provide a 0-10VDC modulated output for economizer damper control.

3. For applications that require integration to the building automation system, provide a BACnet communication interface. If a communication interface is specified, occupancy scheduling in the thermostat is not required.

C. Low Limit Thermostats (Freezestats): Electric two-position type with temperature sensing element and manual reset. Unit to be capable of opening control circuit if any one-foot length of sensing element is subject to a temperature below the setpoint. Length of sensing element to be not less than one lineal foot per square foot of coil surface areas. Unless otherwise indicated, set low limit controls at 36°F.

D. Aquastats: Line voltage type with single pole, double throw switch of adequate rating for the applied load.

E. Remote Bulb Thermostats: Line voltage type with single pole, double throw switch of adequate rating for the applied load. Thermostat to have adjustable setpoint suitable for controlled load.

F. Immersion Type Thermostat Sensors: Rod and tube type with linear output. Provide separable wells with heat conductive fluid for installation in pipeline. Units shall be factory calibrated.

G. Firestats: UL labeled, manual reset, line voltage type with 135°F setpoint.

2.05 DUCT SMOKE DETECTOR AND FIRE ALARM INTERFACE MODULES

A. Detectors with auxiliary contacts or fire alarm control modules will be provided by Division 28. Provide wiring, conduit, and necessary interface with fire alarm system to perform specified sequence of operation.

2.06 TEMPERATURE CONTROL PANELS

A. Constructed of steel or extruded aluminum, with hinged door, keyed lock, and baked enamel finish. Install controls, relays, transducers and automatic switches inside panels. Label devices with permanent printed labels and provide as-built wiring/piping diagram within enclosure. Provide raceways for wiring and poly tubing within panel for neat appearance and to separate high and low voltage wiring. Provide termination blocks and resettable circuit breaker for 120VAC power wiring. Provide label within the panel indicating circuit number of 120VAC serving panel. Label outside of panel with panel number corresponding to plan tags and as-built control drawings as well as building system(s) served.

B. Provide a service shutdown toggle switch for each air handling unit system located inside the temperature control panel that will initiate a logical shutdown of the air handling unit system. Label the switch so it is clear which position is shutdown and which is auto.

2.07 TEMPERATURE SENSORS

A. Thermistor temperature sensor manufacturers: PreCon, BAPI, and ACI

B. Use thermistor or RTD type temperature sensing elements constructed so accuracy and life expectancy is not affected by moisture, physical vibration, or other conditions that exist in each application.

C. RTD's shall be of nickel or platinum construction and have a base resistance of 1000Ω at 70°F and 77°F respectively. 100Ω platinum RTD's are acceptable if used with temperature transmitters.

D. The temperature sensing device used must be compatible with the DDC controllers used on the project.

RTD	
Accuracy (Room Sensor Only)	minimum ± 1.0°F
Accuracy (Averaging)	minimum ± 1.2°F
Accuracy (Other than Room Sensor or Averaging)	minimum ± 0.65°F
Range	minimum -40 - 220°F
Thermistor	
Accuracy (All)	minimum ± 0.36°F
Range	minimum -30 - 230°F
Heat Dissipation Constant	minimum 2.7 mW/°C
Temperature Transmitter	
Accuracy	minimum ± 0.1°F or ±0.2% of span
Output	4-20 mA

E. Provide limited range or extended range sensors if required to sense the range expected for a respective point. Use RTD type sensors for extended ranges beyond -30 to 230°F. If RTD's are incompatible with DDC controller direct temperature input use temperature transmitters in conjunction with RTD's.
F. Use wire size appropriate to limit temperature offset due to wire resistance to 1.0°F. If offset is greater than 1.0°F due to wire resistance, use temperature transmitter. If feature is available in DDC controller, compensate for wire resistance in software input definition.
G. Provide sensors in occupied spaces with brushed aluminum or brushed nickel covers unless otherwise noted or features specified will not allow for this. Sensors in unoccupied spaces shall have metal enclosure. Terminal unit sensors with setpoint adjustments and digital displays may use plastic covers. Provide information to the AE on sensor colors offered by the manufacturer and obtain approval on what color should be provided on the project.
H. Terminal unit sensors shall be provided with digital displays that indicate room temperature and setpoint and have a manual occupancy override and indication of occupancy status. Provide setpoint adjustment as specified in the control diagram and sequence of operation.
I. Use averaging elements on duct sensors when the ductwork is ten square feet or larger. All mixed air and heating coil discharge sensors shall have averaging elements regardless of duct size.
J. In piping systems use temperature sensors with separable wells designed to be used with temperature element.

2.08 HUMIDITY SENSORS

A. Use capacitive thin-film polymer sensor types with a range of 0-100% RH. Accuracy to be no less than ±2% in the range of 20% RH to 80% RH with a response time of 120 seconds or less. Provide covers for room humidity sensors as specified for temperature sensors.
B. For outside air applications, use sensor designed for outside air use along with weather enclosure. Provide sensor equal to Vaisala Model HMD60UO w/ DTR503B enclosure and weather resistant mounting hardware.

2.09 PRESSURE TRANSDUCERS (AIR)

A. Provide pressure transducers specified below for the following applications:
   1. Duct static pressure applications where setpoints are specified to control at greater than 0.1" w.c.
   2. Pitot type fan inlet air flow stations.
   3. Terminal unit air flow measurement regardless of the minimum velocity pressure unless otherwise noted in the contract documents.
B. Manufacturers: Mamac Systems, Setra, and Veris Industries.
C. Provide a transmitter that operates on the capacitance principle and is capable of sensing low positive, negative or differential pressures. Transmitter shall have a minimum of three pressure ranges adjustable by an onboard switch or jumper. Size the transmitter where the middle or high range is suitable for the application. Use a bi-directional transmitter for applications that may have both positive and negative pressure excursions. Transmitter shall be provided with an integral four-digit display of the pressure sensed.

Accuracy (including non-linearity and hysteresis)	± 1% FS
Compensated Temperature Range	32°-140° F
Temperature Effect	0-1"wc Range .09% FS/°F; >1"wc Range .02% FS/°F
Output	4-20 MA
Load Impedance (smallest maximum acceptable)	800 Ω max.
Operating Temperature	32°-140° F

D. Pressure transducers used for supply VAV box flow applications do not need to have adjustable pressure ranges or integral display.
E. Provide pressure transducers specified below for the following applications:
   1. Duct static pressure applications where setpoints are specified to control at 0.1" w.c. or lower.
   2. All duct mounted pitot type air flow stations.
   3. Space/building static control or monitoring.

F. Manufacturers: Paragon Controls MicroTrans, Air Monitor Veltron DPT2500 Plus.

G. The airflow transducer shall provide noise filtration and automatic auto-zeroing. The automatic zeroing circuit shall be capable of maintaining the transducer output to within ±0.25% of operating span. The transducer output shall be locked and maintained at the last given output value during the automatic zeroing period so as not to interrupt the automatic control process. Use a bi-directional transmitter for applications that may have both positive and negative pressure excursions. Transmitter shall be provided with an integral four-digit display of the pressure sensed.
   1. Transducer Span: <2 times the design velocity pressure at maximum flow, single range
   2. Accuracy: ±0.25% of full scale, including non-linearity, hysteresis, deadband, and non-repeatability
   3. Temperature Effect: ±0.15% of full scale/°F
   4. Response: 0.5 sec. for 98% of full span change
   5. Overpressure: 5 PSIG Proof
   6. Power: 24VAC/VDC
   7. Analog Output: 0-5VDC, 0-10VDC, or 4-20mA field adjustable
   8. Auto Zero Frequency: every 1 to 24 hours on 1 hour intervals

H. For space or building static pressure monitoring, use Vaisala model SPH10 Static Pressure Head for outside air reference. Mount in location shown on plans or approved by AE.

2.10 PRESSURE TRANSDUCERS (LIQUID)

A. Provide a transmitter that utilizes capacitive or thin film strain gauge sensing. Provide for an analog gauge piped in parallel with the transducer. Gauge shall meet specifications as specified in Section 23 05 15 – Piping Specialties. Coordinate with Contractor to provide and install this gauge. For differential pressure applications provide with bypass valve manifold assembly with valved venting capability.

Accuracy (including non-linearity and hysteresis)	± 0.5% FS
Compensated Temperature Range	32°-150° F
Temperature Effect (over compensated range)	0.03%/°F;
Output	4-20 MA
Load Impedance (smallest maximum acceptable)	600 Ω Minimum
Operating Temperature	0°-175° F
Hysteresis	0.75% of span

2.11 DIFFERENTIAL PRESSURE SWITCHES

A. Differential pressure switches shall sense both inlet and outlet of fans and pumps. Device shall be rated for 150% of maximum system pressures that may be encountered. Provide with pressure differential that will be required to meet specified operation and/or to prevent nuisance "toggling" of the device in the system served.

2.12 CURRENT STATUS SWITCHES

A. Provide a current sensor with adjustable threshold and digital output with LED display, equal to a Veris model H-708/H-904. Threshold adjustment must be by a multi-turn potentiometer or set by multiprocessor that will automatically compensate for frequency and amperage changes associated with variable frequency drives. When used on variable speed motor applications, use a current sensor that will not change state due to varying speeds.

2.13 OCCUPANCY SENSOR WIRING

A. This contractor shall provide wiring for all occupancy sensors to BAS contacts. Division 26 Contractor shall provide a single set of auxiliary contacts for each lighting zone (room). These contacts shall be wired in parallel by this contractor. When one HVAC zone handles multiple lighting zones (rooms), these contacts shall be wired in parallel by this contractor (Division 23). Coordinate all work with Division 26.

2.14 CARBON DIOXIDE (CO_2) SENSOR

A. Provide a Carbon Dioxide (CO_2) sensor that shall utilize non-dispersive infrared (NDIR) technology. The sensor shall have a linear analog output over a range of 0-2000 ppm and have built in display of CO_2 level. The sensor shall have an automatic calibration algorithm that will compensate for sensor drift over time due to sensor element degradation. Unit shall be provided with a 0-10VDC or 4-20mA analog output that is selectable and a field

adjustable relay alarm output. Accuracy shall be better than ±5% of reading or ±50ppm whichever is higher. The sensor shall be user calibratible with a minimum calibration interval of five years.

2.15 POWER SUPPLIES

A. Provide all required power supplies for transducers, sensors, transmitters and relays. All low voltage transformers shall have a resettable secondary circuit breaker and be listed as class 2 power supplies.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install system with trained mechanics and electricians employed by the control equipment manufacturer or an authorized representative of the manufacturer. Where installing contractor is an authorized representative of the control manufacturer, such authorization shall have been in effect for a period of no less than three years.

B. Install all control equipment, accessories, wiring, and piping in a neat and workmanlike manner. All control devices must be installed in accessible locations. This contractor shall verify that all control devices furnished under this Section are functional and operating the mechanical equipment as specified in Section 23 09 93 – Sequence of Operations for HVAC Controls.

C. Label all control devices with the exception of dampers, valves, and terminal unit devices with permanent printed labels that correspond to control drawings. Temperature control junction and pullboxes shall be identified utilizing spray painted green covers. Other electrical system identification shall follow the Division 26 identification specification requirements.

D. All control devices and electrical boxes mounted on insulated ductwork shall be mounted over the insulation. Provide mounting stand-offs where necessary for adequate support. Cutting and removal of insulation to mount devices directly on ductwork is not acceptable. This contractor shall coordinate with the insulation contractor to provide for continuous insulation of ductwork.

E. Mounting of electrical or electronic devices shall be protected from weather if the building is not completely enclosed. This Contractor shall be solely responsible for replacing any equipment that is damaged by water that infiltrates the building if equipment is installed prior to the building being enclosed.

F. Provide all electrical relays and wiring, line and low voltage, for control systems, devices and components. Install all high voltage and low voltage wiring (includes low voltage cable) in metal conduit, Electrical Non-metallic Tubing (ENT), or Electrical Metallic Tubing (EMT), as scheduled below and hereafter referred to generically as conduit. See Wire and Air Piping Conduit Installation Schedule below for specific conduit or tubing to be used. All conduit must be installed in accordance with electrical sections (Division 26) of this specification and the National Electrical Code.

G. Conduit shall be a minimum of 1/2 " for low voltage control provided the pipe fill does not exceed 40%.

H. Minimum low voltage wiring gauge to be 18 AWG for outputs and 20 AWG for inputs. All low voltage wiring to be stranded.

I. Low voltage wiring can be run without conduit above accessible lay-in tile ceilings. All wiring in mechanical rooms, above inaccessible hard ceilings, exterior locations, and in any exposed areas, and in all other locations should be in conduit. Wire for wall sensors must be run in conduit. Wiring for radiation valves shall be run in conduit where routed through walls.

J. Where wiring is installed free-air, installation shall consider the following:
   1. Wiring shall utilize the cable tray wherever possible.
   2. Wiring shall run at right angles and be kept clear of other trades work.

3. Wiring shall be supported utilizing "J" or "Bridal-type" steel mounting rings anchored to ceiling concrete, piping supports, walls above ceiling or structural steel beams. Mounting rings shall be of open design (not a closed loop) to allow additional wire to be strung without being threaded through the ring. For mounting rings that do not completely surround the wire, attach the wire to the mounting ring with a strap.
4. Supports shall be spaced at a maximum 4-foot interval unless limited by building construction. If wiring "sag" at mid-span exceeds 6-inches; another support shall be used.
5. Wiring shall never be laid directly on the ceiling grid or attached in any manner to the ceiling grid wires.
6. Wall penetrations shall be sleeved.

K. Wiring shall not be attached to existing cabling, existing tubing, piping, ductwork, ceiling supports or electrical or communications conduit.

L. Control panels serving equipment fed by emergency power shall also be served by emergency power.

M. This contractor shall be responsible for all 120VAC power, not provided in the Division 26 specifications, required for equipment provided under this section.

N. Provide communication trunk wiring to integrated devices (i.e. VFD's, Flow Meters, Chillers, Lighting Panels, Electrical Meters, etc.) that are specified to be connected to the building automation system. Communication trunk wiring shall be as required by the equipment specified under the Section 23 09 23 – Direct Digital Control System for HVAC and shall be routed to the DDC panel designated for that equipment as shown on the plans or the closest DDC panel if not designated. If communication trunks required daisy chained style wiring, provide two communication cables to the DDC panel so that the communication trunk is not dead ended.

O. Install "hand/off/auto" selector switches on systems where automatic interlock controls are specified and "hand/off/auto" selector switches are not supplied with the equipment controlled. Control panel power will not be required for "hand" switch to operate. When switch is in "hand" position, allow manual operation of the selected device without operating the interlocked motors but allowing all unit safety devices to stay in the circuit.

P. All electrical wiring is to be permanently tagged or labeled within one inch of terminal strip with a numbering system to correspond with the "Record Drawings".

Q. After completion of installation, test and adjust control equipment. Submit data showing set points and final adjustments of controls.

3.02 WIRE AND AIR PIPING CONDUIT AND TUBING INSTALLATION SCHEDULE

A. The following conduit schedule shall apply to both polyethylene tubing and wire in conduit where conduit is specified for air tubing or wiring. Conduit and tubing referenced below shall meet specifications in Division 26 and as defined below.

B. Conduit other than that specified below for specific applications shall not be used.

C. Exposed Outdoor Locations: Rigid steel conduit.

D. Concealed in Concrete and Block Walls: Rigid steel conduit. Schedule 40 PVC conduit. Electrical Nonmetallic Tubing (ENT).

E. Concealed Dry Interior Locations: Rigid steel conduit. Intermediate metal conduit. Electrical metallic tubing.

F. Exposed Dry Interior Locations: Rigid steel conduit. Intermediate metal conduit. Electrical metallic tubing.

3.03 CONTROL DAMPERS

A. All control dampers furnished by the control manufacturer are to be installed by the Contractor under the coordinating control and supervision of the Temperature Control Contractor in locations shown on plans or where required to provide specified sequence of control.

B. Coordinate installation with the sheetmetal installer to obtain smooth duct transitions where damper size is different than duct size. Blank off plates will not be accepted. Transitions required to facilitate dampers shall be provided by Contractor.

C. Each operator shall serve a maximum damper area of 36 square feet. Where larger dampers are used, provide multiple operators.

D. Furnish control dampers as shown on drawings and/or as required to perform control sequences specified, except those furnished with other equipment.

E. Control dampers furnished by Temperature Control Contractor shall be installed by Contractor under coordinating control and supervision of Temperature Control Contractor.

3.04 CONTROL VALVES

A. All temperature control valves furnished by the control manufacturer are to be installed by the Contractor under the coordinating control and supervision of the Temperature Control Contractor in locations shown on plans or where required to provide specified sequence of control.

B. Provide pilot positioners on all valves where more than one pneumatic operator is controlled in sequence, for all valves 3" and larger, or where required to provide sufficient power. Where two or more valves are operated in sequence, pilot positioners to have adjustable start point (2-12 psig) and span (5-13 psig).

3.05 CONTROL SYSTEM INSTRUMENTATION

A. For pneumatically actuated systems install pressure gauges as follows: for indication of supply air pressure in each temperature control panel; at the output of pneumatic/electric transducers; the output of each pneumatic controller; the output of each solenoid air valve; the input of each PE switch; at each modulated damper and valve except terminal devices; other points where the visible indication of air pressure is required for operating and maintenance purposes. On dampers and valves with pilot positioners, locate gauge in the output of positioner to controlled device. Mount gauges so they are visible when looking at the monitored device. At each receiver controller input port, install a 1-1/2" diameter dial indicator with scale to match input range (in degrees F., % R.H., in. w.c., etc.). Equip control air output line with a 1-1/2" diameter air pressure gauge.

B. Install thermometers at each point of temperature transmission (sensors) and control, except reheat coils, unless the drawings indicate a thermometer is to be installed by the piping or sheetmetal installer. Install thermometers to permit easy reading from the floor or operating platform. Provide remote mounting or swiveled mounting as required for easy reading. Flush mounting where not easily read is not acceptable.

3.06 ROOM THERMOSTATS AND TEMPERATURE SENSORS

A. Check and verify location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation. Locate room thermostats and sensors 48 inches above floor and coordinate with Architectural elevations. Align with light switches and humidistats. For drywall installations, thermostat mounting shall use a back-box attached to a wall stud, drywall anchors are not acceptable.

B. Any room thermostats or sensors mounted on an exterior wall shall be mounted on a thermally insulated sub-base. Subbase to provide a minimum of one half inch of insulation.

C. Where thermostats or sensors are mounted on exterior walls or in any location where air transfer will affect the measured temperature or humidity seal the conduit and any other opening that will affect the measurement.

D. Provide guards on thermostats in entrance hallways, other public areas, or in locations where thermostat is subject to physical damage.

3.07 TEMPERATURE CONTROL PANELS

A. Mount control panels adjacent to associated equipment on vibration-free walls or freestanding angle iron supports. One cabinet may accommodate more than one system in same equipment room. Provide permanent printed labeling for instruments and controls inside cabinet and engraved plastic nameplates on cabinet face.

B. Provide as-built control drawings of all systems served by each local panel in a location adjacent to or inside of panel cover. Provide a protective cover or envelope for drawings.

3.08 DIFFERENTIAL PRESSURE SWITCHES

A. Provide for each fan or pump specified or shown on control diagrams on drawings. Provide shutoff valves at piping takeoff points. Readjust pressure and/or differential setpoints for proper operation after final balancing is completed.

3.09 CURRENT STATUS SWITCHES

A. Provide for each fan or pump specified or shown on control diagrams on drawings. Set threshold adjustment to indicate belt or coupling loss. Readjust threshold for proper operation after final balancing is completed. Use the variable frequency drive (VFD) integrated relay output for motor status, if provided on the VFD, in lieu of a discrete current switch. A separate current switch provided under this section shall be wired in parallel with the VFD motor status relay when a bypass starter is provided on the VFD to prove motor status in the bypass mode.

3.10 CARBON DIOXIDE (CO_2) SENSOR

A. Install in accordance with room temperature and sensor installation instructions in this specification.
B. Provide CO_2 sensors in the following locations:
   1. Designate CO_2 sensor locations here or on the drawings

3.11 TRAINING

A. See Section 23 05 00 – Common Work Results for HVAC for general training requirements.
B. Contractor to provide factory authorized representative and/or field personnel knowledgeable with the operations, maintenance and troubleshooting of the system and/or components defined within this section for a minimum period of 8 hours.
C. Provide one training session per shift of building operating engineers at two times:
   1. At the start of the warranty period.
   2. After completion of 9 months of warranty period.

END OF SECTION

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SECTION 23 09 23
DIRECT DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. The work associated with this section WILL be bid as part of the Division 23 scope of work.

1.02 SECTION INCLUDES

A. Work in this section includes Direct Digital Control (DDC) panels, main communication trunk, software programming, and other equipment and accessories necessary to constitute a complete Direct Digital Control (DDC) system. This system interfaced with pneumatic/electric controls (Section 23 09 14 – Pneumatic and Electric Instrumentation and Control Devices for HVAC) utilizing Direct Digital Control signals to operate actuated control devices shall meet, in every respect, all operational and quality standards specified herein.
   1. Local Control Panels
   2. Direct Digital Controls (DDC)
   3. Networking/Communications
   4. BACnet Requirements
   5. Supervisory Controllers
   6. System Software Features
   7. Programmable Controllers
   8. Application Specific Controllers - HVAC
   9. Operator Interface Requirements
   10. Operator Workstation & DDC Server
   11. Web Based HTML Interface
   12. Portable Operator Terminal
   13. ASC Portable Service Terminal

B. Provide all labor and software updates required so that the manufacturer's current software is provided for a period of 3 years after date of substantial completion.

C. Provide graphic-based displays for all systems.

1.03 RELATED WORK

A. Applicable provisions of Division 1 govern work under this section.
B. Section 23 05 00 – Common Work Results for HVAC
C. Section 23 05 93 – Testing, Adjusting, and Balancing for HVAC - Coordination
D. Section 23 09 14 – Pneumatic and Electric Instrumentation and Control Devices for HVAC
E. Section 23 09 93 – Sequence of Operation for HVAC Controls
F. Division 23 – HVAC - Equipment provided to be controlled or monitored
G. Division 26 – Electrical - Equipment provided to be controlled or monitored

1.04 SUBMITTALS

A. Refer to Section 23 05 00 – Common Work Results for HVAC, Submittals. In addition to the general content specified under Section 23 05 00 – Common Work Results for HVAC, supply the following submittals:
   1. DDC Controls

B. Include the following information:

C. Details of construction, layout, and location of each temperature control panel within the building, including instruments location in panel and labeling. Indicate which piece of mechanical equipment is associated with each controller and what area within the building is being served by that equipment. For terminal unit control, provide a room schedule that lists mechanical equipment tag, room number of space served, address of DDC controller, and any other pertinent information required for service.

D. Product Data: Submit manufacturer's specifications for each control device furnished, including installation instructions and startup instructions. General catalog sheets showing a series of the same device is not acceptable unless the specific model is clearly marked. Annotated software program documentation shall be submitted for system sequences, along with descriptive narratives of the sequence of operation of the entire system involved. Submit wiring diagram for each electrical control device along with other details required to demonstrate that the system has been coordinated and will function as a system.
E. Maintenance Data: Submit maintenance data and spare parts lists for each control device. Include this data in maintenance manual.
F. Record Drawings: Prior to request for final payment provide complete composite record drawings to incorporate the DDC and Pneumatic/Electric fieldwork. All software addressing for device communication shall be noted for all devices provided under this section and the communication addressing required for devices provided by others that are integrated into the direct digital control system provided under this section. Coordinate with the supplier of the equipment specified to be interfaced through digital communications for communication addressing. Provide circuit number of 120VAC panel power circuit(s) feeding each control panel on record drawings. Label circuit number(s) inside the panel served.

1.05 REFERENCE STANDARDS

A. FCC Part 15, Subpart J, Class A - Digital Electronic Equipment to Radio Communication Interference

1.06 QUALITY ASSURANCE

A. Manufacturers: Installer: A firm specializing and experienced in DDC control system installation for no less than 3 years. All engineering and commissioning work shall be done by qualified personnel in the direct employ of this manufacturer, or of an Authorized Representative of that manufacturer that provides engineering and commissioning of the manufacturers control equipment. Where installing contractor is an authorized representative of the control equipment manufacturer, submit written confirmation of such authorization. Indicate in letter of authorization that the installing contractor has successfully completed all necessary training required for the engineering, installation, and commissioning of equipment and systems to be provided for the project, and that such authorization has been in effect for a period of not less than three years. The letter of authorization should also indicate that the installing contractor is authorized to install the manufacturer's DDC equipment at the project location at the time the project is bid. Installation of the equipment shall be done by qualified mechanics and/or electricians in the direct employ or be directly subcontracted and under the supervision of the manufacturer or Authorized Representative.
C. Response Time: During warrantee period, four (4) hours or less, 24-hours/day, 7 days/week.
D. Electrical Standards: Provide electrical products, which have been tested, listed and labeled by Underwriters' Laboratories (UL) and comply with NEMA standards.
E. DDC Standards: DDC manufacturer shall provide written proof with shop drawings that the equipment being provided is in compliance with FCC rules governing the control of interference caused by Digital Electronic Equipment to Radio Communications (Part 15, Subpart J, Class A).

1.07 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified in Section 23 05 00 – Common Work Results for HVAC.
B. In addition to the general content specified in Section 23 05 00 – Common Work Results for HVAC, supply the following additional documentation:

1.08 DELIVERY. STORAGE AND HANDLING

A. Provide factory-shipping cartons for each piece of equipment and control device. This contractor is responsible for storage of equipment and materials inside and protected from the weather.

PART 2 – **PRODUCTS**

2.01 **GENERAL**

A. Provide DDC control products in sizes and of capacities as required, conforming to manufacturer's standard materials and components as published in their product information, designed and constructed as recommended by the manufacturer and as required for application indicated.
B. System shall be capable of operating with 120 VAC power supply, fully protected with a shutdown-restart circuit, and associated hardware and software.

2.02 **LOCAL CONTROL PANELS**

A. Use control panels with suitable mounting brackets for each supply fan system. Locate panel adjacent to system served.
B. Fabricate panels of 14 gauge furniture grade steel or 6063-T5 extruded aluminum alloy, totally enclosed on six sides, hinged door and keyed lock, with manufacturer's standard shop painted finish and color.
C. Provide UL listed cabinets for use with line voltage devices.
D. Plastic control enclosures will be approved provided all conduits are bonded and grounded.
E. Provide control panels for all DDC Controllers, ASC's and associated function modules. All controls to be in panels except for terminal unit controllers mounted within the terminal unit equipment enclosure or VAV box controllers designed to be directly mounted on air terminals. Provide terminal unit equipment enclosures with removable cover for all terminal units located in exposed ceilings that completely enclose the DDC controller and allow for conduit terminations.
F. Permanently label all controls; tag all control wiring.

2.03 **DIRECT DIGITAL CONTROLS**

A. System to be capable of integrating multiple building functions, including equipment supervision and control, alarm management, energy management, and trend data collection.
B. DDC to consist of Supervisory Controllers, Programmable Controllers, stand-alone Application Specific Controllers (ASC's), Operators Terminals, Operator Workstations, DDC system servers, and other operator interface devices.
C. The system shall be modular in nature, and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, ASC's, and operator devices.
D. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.

2.04 **NETWORKING/COMMUNICATIONS**

A. The design of the DDC shall be networked. The highest level networking shall use Ethernet and the sub-level networking shall use serial communications. Inherent in the system's design shall be the ability to expand or modify the highest network either via a local area network (LAN), wide area network (WAN), or a combination of the two schemes.
B. The highest level DDC communications network shall be capable of direct connection to and communication with a high-speed LAN or WAN utilizing an Ethernet connection. Communication protocol used shall be BACnet/IP.
C. The supervisory controller shall directly oversee a local network such that communications may be executed directly to and between programmable controllers and ASC's. All operator devices, either network resident or connected via dial-up modems, shall have the ability to access all points and application reports on the network.
D. Provide serial communication ports on all ASC's for operator's terminal communications with the DDC Controller.
E. Access to system data shall not be restricted by the hardware configuration of the DDC system.
F. Global data sharing or global point broadcasting shall allow point data to be shared between programmable controllers and ASC's when it would be impractical to locate multiple sensors.
G. Network design shall include the following provisions:
    1. Data transfer rates for alarm reporting and quick point status from multiple programmable controllers and ASC's. The minimum baud rate shall be 9600 baud.

2. Support of any combination of programmable controllers and ASC's. A minimum of 32 programmable controllers and ASC's shall be supported on a single local network. The buss shall be addressable for up to 32 ASC's.
3. Detection of single or multiple failures of programmable controllers and ASC's or the network media.
4. Error detection, correction, and re-transmission to guarantee data integrity.
5. Use commonly available, multiple-sourced, networking components.
6. Use of an industry standard communication transport, such as ARCNET, Ethernet, and IEEE RS-485 communications interface.

2.05 BACNET REQUIREMENTS

A. BACnet of highest level network communications will utilize BACnet/IP over Ethernet.
B. Supervisory controllers shall provide a Protocol Implementation Conformance Statement (PICS) and BACnet Interoperability Building Blocks (BIBB'S) as required by the American National Standards Institute/American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ANSI/ASHRAE) Standard 135-2001, BACnet protocol.
C. In general all highest level networked supervisory devices shall support the following:
   1. Segmentation Capability
   2. Segmentation requests supported
   3. Segmentation responses supported
D. Standard Object Types Supported:
   1. Analog input
   2. Analog output
   3. Analog value
   4. Binary input
   5. Binary output
   6. Binary value
   7. Calendar
   8. Device
   9. Event enrollment
   10. Group
   11. Multistate input
   12. Multistate output
   13. Multistate value
   14. Notification class
   15. Schedule
E. Data Link Layer Option
   1. BACnet Internet Protocol (IP) (Annex J)
F. Networking Options
G. BACnet/IP Broadcast Management Device (BBDM)
H. Character Sets supported
   1. ANSI X3.4
   2. ISO 10646 Universal Character Set-2

2.06 SUPERVISORY CONTROLLERS

A. Supervisory controllers shall be microprocessor-based, multi-tasking, multi-user and digital control processors.
B. Each supervisory controller shall have sufficient memory to support its own operating system and databases including:
   1. Control processes
   2. Energy management application
   3. Alarm management
   4. Trend data
   5. Maintenance support applications
   6. Operator I/O
   7. Dial-up communications

8. Manual override monitoring

C. The system shall be modular in nature, and shall permit easy expansion through the addition of field controllers, sensors, and actuators.

D. Supervisory controllers shall provide at least two RS-232C, USB serial communication ports, or Ethernet ports for simultaneous operation of multiple operator I/O devices, such as laptop computers, personal computers, and video display terminals.

E. Supervisory controllers shall monitor the status of all overrides and include this information in the logs and summaries to inform the operator that automatic control has been inhibited.

F. Each supervisory controller shall continuously perform self-diagnostics, communications diagnostics, and diagnostics of all subsidiary equipment. Supervisory controllers shall provide both local and remote annunciation of any detected component failures, or repeated failure to establish communication. Indication of the diagnostic results shall be provided at each supervisory controller.

G. Isolation shall be provided at all network terminations, as well as all field point terminations, to suppress induced voltage transients consistent with IEEE Standard 587-1980. Isolation levels shall be sufficiently high to allow all signal wiring to be run in the same conduit as high voltage wiring acceptable by electrical code.

H. In the event of the loss of normal power, there shall be an orderly shutdown of the supervisory controller to prevent the loss of data base or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data, and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours.

I. Upon restoration of normal power, the supervisory controller shall automatically resume full operation without manual intervention.

J. Should supervisory controller memory be lost for any reason, the supervisory controller shall have the capability of reloading its programming via high speed local area network from the control system archive workstation or server, the local RS-232C port, or telephone line dial-in.

2.07 SYSTEM SOFTWARE FEATURES

A. All necessary software to form a complete operating system, as described in this specification, shall be provided as an integral part of the supervisory controller, and shall not be dependent upon higher level computer for execution.

B. Control software shall include a provision for limiting the number of times that each piece of equipment may be cycled within any one-hour period.

C. The system shall provide protection against excessive demand situations during start-up periods by automatically introducing time delays between successive start commands to heavy electrical loads.

D. Supervisory controllers shall have the ability to perform any or all of the following energy management routines:
   1. Time of day scheduling
   2. Calendar based scheduling
   3. Holiday scheduling
   4. Optimal start
   5. Optimal stop
   6. Demand limiting
   7. Load rolling
   8. Heating/cooling interlock

E. All programs to be executed automatically without the need for operator intervention, and be flexible enough to allow user customization. Programs shall be applied to building equipment described in Section 23 09 93 – Sequence of Operations for HVAC Controls of this specification.

F. Supervisory controllers shall be able to execute configured processes defined by the user to automatically perform calculations and control routines.

G. It shall be possible to use any of the following in a configured process:
   1. Any system-measured point data or status
   2. Any calculated data
   3. Any results from other processes
   4. Boolean logic operators (and, or)

H. Configured processes may be triggered based on any combination of the following:
   1. Time of day

2. Calendar date
3. Other processes
4. Events (e.g., point alarms)

I. A single process shall be able to incorporate measured or calculated data from any and all other ASC's.

J. A single process shall be able to issue commands to points in any and all other programmable controllers and ASC's on the local network.

K. Alarm management shall be provided to monitor, buffer, and direct alarm reports to operator devices and memory files. Each supervisory controller shall perform distributed, independent alarm analysis and filtering to minimize network traffic and prevent alarms from being lost. At no time shall the ability of supervisory controllers to report alarms be affected by either operator activity at the local I/O device or communications with other ASC's on the network.

L. All alarm or point change reports shall include the English language description of each point and the time and date of the occurrence.

M. The user shall be able to define the specific system reaction for each point. Alarms shall be prioritized to minimize nuisance reporting and to speed operator response to critical alarms. A minimum of three priority levels shall be provided. Users shall have the ability to manually inhibit alarm reporting for each point.

N. The user shall also be able to define conditions under which point changes need to be acknowledged by an operator and/or logged for analysis at a later date.

O. Alarms reports and messages shall be directed to an operator device.

P. In addition to the point's descriptor and the time and date, the user shall be able to print, display or store a 60-character alarm message to more fully describe the alarm condition or direct operator response.

Q. Each supervisory controller shall be capable of storing a library of at least 100 messages. Each message may be assignable to any number of points in the panel.

R. A data collection utility shall be provided to automatically sample, store, and display system data.

S. Measured and calculated analog and binary data shall be assignable to user definable trends for the purpose of collecting operator specified performance data over extended periods of time. Sample intervals of 1 minute to 24 hours, in one minute or one hour intervals, shall be provided. Each supervisory controller shall have a dedicated buffer for trend data and shall be capable of storing 16 trend logs. Each trend log shall have up to four points trended at 48 data samples each. Data shall be stored at the supervisory controller and up-loaded to the DDC system server when archiving is desired.

T. Supervisory controllers shall automatically accumulate and store runtime hours for binary input and output points specified in Section 23 09 14 – Pneumatic and Electric Instrumentation and Control Devices for HVAC.

U. Supervisory controllers shall automatically sample, calculate and store consumption totals on a daily, weekly, or monthly basis, user defined, for user-selected analog and binary pulse input type points.

V. Totalization shall provide calculation and storage accumulations of up to 9,999,999 units (e.g., KWH, gallons KBTU, tons, etc.).

W. The totalization routine shall have a sampling resolution of one minute.

X. The user shall have the ability to define a warning limit. Unique, user specified messages shall be generated when the limit is reached.

Y. The information available from pulse totalization shall include, but not be limited to, the following:
1. Peak demand, with date and time stamp
2. 24-hour demand log
3. Accumulated KWH for day
4. Sunday through Saturday KWH usage
5. Demand KW annual history for past 12 periods
6. KWH annual history for past periods

Z. Supervisory controllers shall have the ability to count events, such as the number of times a pump or fan system is cycled on and off.

AA. The event totalization feature shall be able to store the records associated with a minimum of 9,999,999 events before reset.

2.08 PROGRAMMABLE CONTROLLERS

A. Programmable controllers shall be provided with a software program that shall allow the user to design flexible software algorithms for the control sequences as described in Section 23 09 14 – Pneumatic and Electric Instrumentation and Control Devices for HVAC and Section 23 09 93 – Sequence of Operation for HVAC Controls.
B. Programmable controllers shall support all necessary point inputs and outputs to perform the specified control sequence in a totally stand-alone fashion.
C. Each programmable controller shall perform its own limit and status monitoring and analysis to maximize network performance by reducing unnecessary communications.
D. Each programmable controller shall support the use of a locally mounted status and adjust panel interface to allow for the local adjustment of all setpoints, temporary override of any input or output points and status of all points directly at the controller. The capabilities of the locally mounted status and adjust panel shall include, but not be limited to, the following:
   1. Display temperatures
   2. Display status
   3. Display setpoints
   4. Display control parameters
   5. Override binary output control
   6. Override analog output control
   7. Override analog setpoints
   8. Modification of gain and offset constants
E. All system setpoints, proportional bands, control algorithms, and any other programmable parameters shall be stored such that a power failure of any duration does not necessitate reprogramming the programmable controller.
F. Programmable controllers shall support, but not be limited to, the following configurations of systems to address current requirements as described in Section 23 09 14 – Pneumatic and Electric Instrumentation and Control Devices for HVAC and Section 23 09 93 – Sequence of Operation for HVAC Controls and for future expansion of air handling units:
   1. Mixed air handling units
   2. Boiler with pump logic
   3. Hot water heat exchangers
   4. Generic system interlocking through hardware

2.09 APPLICATION SPECIFIC CONTROLLERS - HVAC APPLICATIONS

A. Each supervisory controller shall be able to extend its monitoring and control through the use of stand-alone application specific controllers (ASC's).
B. Each ASC shall operate as a stand-alone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each ASC shall be a microprocessor based, multi-tasking, real-time digital control processor.
C. Each ASC shall have sufficient memory to support its own operating system and databases including:
   1. Control Processes
   2. Energy Management Applications
   3. Operator I/O (Portable Service Terminal)
D. The operator interface to any ASC point or program shall be through the supervisory controller connection to any ASC on the network.
E. ASC's shall directly support the temporary use of a portable service terminal that can be connected to the ASC via zone temperature or directly at the controller. The capabilities of the portable service terminal shall include, but not be limited to, the following information for the ASC:
   1. Display temperatures
   2. Display status
   3. Display setpoints
   4. Display control parameters
   5. Override binary output control
   6. Override analog output control
   7. Override analog setpoints
   8. Modification of gain and offset constants

F. All system setpoints, proportional bands, control algorithms, and any other programmable parameters shall be stored such that a power failure of any duration does not necessitate reprogramming the ASC.
G. ASC's shall support, but not be limited to, the following configurations of systems to address current requirements as described in Section 23 09 14 – Pneumatic and Electric Instrumentation and Control Devices for HVAC and Section 23 09 93 – Sequence of Operation for HVAC Controls portions of this specification, and for future expansion of air handling units:
   1. Variable Air Volume Terminals
   2. Reheat Terminals
   3. Packaged Air Handling Units

2.10 OPERATOR INTERFACE REQUIREMENTS

A. Command Entry/Menu Selection Process: Operator interface software shall minimize operator training through the use of English language prompting and English language point identification.
B. Text-Based Displays: The operator interface shall provide consistent text-based displays of all system point and application data described in this specification. Point identification, engineering units, status indication, and application-naming conventions shall be the same at all operator devices.
C. Graphic-Based Displays: The operator interface shall include graphic based displays of each system on DDC systems that currently employ graphic based displays. The point data associated with each system shall dynamically update at a minimum of every 30 seconds. Graphic displays shall have the ability to be linked to each other to provide a "drill down" capability from main graphic displays to more specific system based displays. Provide a building level graphic display that links to system graphics. For systems that have ASC controlled terminal unit controls, provide a building floor plan with dynamic temperatures shown on the graphic that can be drilled into for more specific terminal information. Points provided in the graphic shall have the override and adjust capability specified under operator commands.
D. Password Protection:
   1. Multiple-level password access protection shall be provided to allow the user/manager to limit control, display, and data base manipulation capabilities as he deems appropriate for each user, based upon an assigned password.
   2. Passwords shall be exactly the same for all operator devices.
   3. A minimum of three levels of access shall be supported:
      a. Level 1 = Data access and display
      b. Level 2 = Level 1 + operator overrides and commands
      c. Level 3 = Level 2 + database generation and modification
   4. A minimum of 4 passwords shall be supported at each supervisory controller.
   5. Operators will be able to perform only those commands available for their respective passwords. Menu selections displayed at any operator device shall be limited to only those items defined for the access level of the password used to log-on.
   6. Provide user definable, automatic log-off timers of from 1 to 60 minutes to prevent operators from inadvertently leaving devices on-line.
E. Operator Commands: The operator interface shall allow the operator to perform commands including, but not limited to, the following:
   1. Start-up or shutdown selected equipment
   2. Adjust setpoints
   3. Override analog and binary outputs
   4. Add/modify/delete time programming
   5. Enable/disable process execution
   6. Lock/unlock alarm reporting for each point
   7. Enable/disable totalization for each point
   8. Enable/disable trending
   9. Enter temporary override schedules
   10. Define holiday schedules
   11. Change time/date
   12. Enter/modify analog alarm limits
   13. Enable/disable analog alarm limits
   14. Enable/disable demand limiting

15. Enable/disable duty cycle

F. Logs and Summaries: Reports shall be generated manually, and directed to the displays. As a minimum, the system shall allow the user to easily obtain the following general listing of all points in the system, which shall include, but not be limited to:
   1. Points currently in alarm
   2. Off-line points
   3. Points currently in override status
   4. Points in weekly schedules
   5. Holiday programming

G. Summaries shall be provided for specific points, for a logical point group, for a user-selected group of groups, or for the entire facility without restriction due to the hardware configuration on the facility management system. Under no conditions shall the operator need to specify the address of hardware controller to obtain system information.

H. System Configuration And Definition:
   1. All temperature and equipment control strategies and energy management routines shall be definable by the operator. System definition and modification procedures shall not interfere with normal system operation and control.
   2. The system shall be provided complete with all equipment, software, and documentation necessary to allow an operator to independently perform the following functions:
      a. Add/delete/modify application specific controllers
      b. Add/delete/modify points of any type, and all associated point parameters, and tuning constants
      c. Add/delete/modify alarm reporting definition for each point
      d. Add/delete/modify energy management applications
      e. Add/delete/modify time and calendar-based programming
      f. Add/delete/modify totalization for every point
      g. Add/delete/modify historical data trending for every point
      h. Add/delete/modify configured control processes
      i. Add/delete/modify dial-up telecommunication definition
      j. Add/delete/modify all operator passwords
      k. Add/delete/modify alarm messages

I. Network Wide Strategy Development: Inputs and outputs for any process shall not be restricted to a single programmable controller or ASC, but shall be able to include data from any and all other programmable controller or ASC's to allow the development of network-wide control strategies.

J. System Definition/Control Sequence: All portions of system definition shall be self-documenting and capable of providing hardcopy printouts of all configuration and application data.

K. Data Base Save/Restore/Back-Up: Backup copies of all programmable controller, ASC and supervisory controller databases shall be stored in at least one personal computer or laptop. Users shall also have the ability to manually execute downloading of a programmable controller, ASC or supervisory controller database.

2.11 OPERATOR WORKSTATION & DDC SYSTEM SERVER

A. A Personal Computer (PC) Operator Workstation and DDC System Server software shall be provided for command entry, information management, network alarm management, and database management and archiving functions. The functions of the operator workstation and DDC system server may reside on a single personal computer. Provide a separate DDC System Server PC if required to perform the specified requirements. All functions specified under the Operator Interface section of this specification must be met.

B. All real-time control functions shall be resident in the stand-alone supervisory controllers to facilitate greater fault tolerance and reliability.

C. Workstation shall be general purpose, commercially available, personal computers with a quad core processor with highest available speed, RAM, hard drive capacity at time of actual purchase. Provide more memory and/or a faster processor if necessary to perform all the functions described in this specification.

D. Sufficient storage shall be provided to accommodate all fully configured point databases all application databases, all graphics databases, all user-defined reports, and all historical data archived as described in this specification.
E. The flat panel display provided for system operation shall have a diagonal screen measurement of no less than 20" and have a minimum display resolution of no less than 1280 x 1024 pixels. Separate controls shall be provided for color, contrast, and brightness. If a laptop is provided, a 17" diagonal screen and have a minimum display resolution of no less than 1280 x 1024 pixels.
F. The ability to print to PDF format will be necessary.
G. Provide software, including but not limited to functions such as:
   1. Grouping point data by systems or types
   2. Displaying trends in textual and graphical format
   3. Application software for programming all DDC controllers specified herein
   4. Graphics definition and development
   5. Managing archive data and programs
H. This contractor shall provide all labor and software upgrades required so that the manufacturer's current software revision is provided at substantial completion. If the manufacturer will be upgrading within three months after substantial completion, the contractor must notify the owner that this will occur before substantial completion and provide a quote for upgrading to the current revision.
I. Prior to installation of any Operator Workstation or DDC System server, the contractor shall work with the owner to ensure that proper virus protection software and security measures are in place before the system is put online.

2.12 WEB BASED HTML BROWSER INTERFACE

A. Provide a HTML based browser interface (Web Server) for accessing the DDC system. This shall include all hardware and software to provide an Ethernet twisted pair connection to the owners local or wide area network (LAN or WAN) that can be used to access the DDC system through a standard internet browser.
B. All information shall be provided to the owners IT staff to facilitate connection through the owners LAN/WAN.
C. At a minimum, this interface shall be capable of all functions described under the Operator Interface section, Password Protection, Operator Commands, and Logs and Summary subsections of this specification.

2.13 PORTABLE OPERATOR TERMINAL

A. Provide a portable interface for accessing the DDC system from a connection to a supervisory controller. This device shall, at a minimum, be capable of all functions described under the Operator Interface section, Password Protection, Operator Commands, and Logs and Summary subsections of this specification.

2.14 ASC PORTABLE SERVICE TERMINAL

A. Provide a portable service terminal capable of interfacing to ASC's through a local serial port located on the ASC or if a remote thermostat is provided, at the thermostat. This terminal shall be capable of displaying all input and output points, adjusting all setpoints, and adjusting all tuning parameters for the ASC. This device is primarily for setup and servicing of ASC's.

PART 3 – EXECUTION

3.01 GENERAL

A. This contractor shall provide all labor, materials, engineering, software permits, tools, check-out and certificates required to install a complete DDC system as herein specified.

3.02 INSTALLATION

A. All work and materials are to conform in every detail to the rules and requirements of the National Electrical Code and present manufacturing standards. All wiring and cable installation shall conform with the wiring installation as specified in the installation section of Section 23 09 14 – Pneumatic and Electric Instrumentation and Control Devices for HVAC. All material shall be UL approved.
B. Install system and materials in accordance with manufacturer's instructions, rough-in drawings and details on drawings.
C. Line voltage wiring to power the DDC Controllers, not provided by the Division 26 contractor, to be by this contractor.
D. Control panels serving equipment fed by emergency power shall also be served by emergency power.
E. Provide uninterruptable power supplies where necessary to provide proper startup of equipment or to accomplish power restart control sequences specified.
F. Mount control panels adjacent to associated equipment on vibration-free walls or freestanding angle iron supports. One cabinet may accommodate more than one system in same equipment room. Provide printed plastic tags for instruments and controls inside cabinet and on engraved plastic nameplates cabinet face.
G. Provide as-built control drawings of all systems served by each local panel in a location adjacent to or inside of panel cover. Provide a protective cover or envelope for drawings.
H. Where a new system is required to be extended to an existing owner Building Automation Network (BAN) (typically connected via the owner's Local Area Network (LAN) or Wide Area Network (WAN)), extension of the data-net between DDC Controllers and to the BAN to be by this contractor.
I. Provide all necessary routers and or repeaters to accomplish connection to the LAN via the panel-mounted port provided.
J. Provide two data jacks in control panels housing supervisory controllers and allocate 6"x6" for each data jack in the panel. The first jack will be used for connecting the supervisory controller to the Building Automation Network (BAN). The second jack will be used as a spare for connecting to the BAN by service personnel.
K. All cables to the DDC panels shall be extended in the DDC panel with sufficient spare cable (minimum of 5') to allow termination.

3.03 TRAINING

A. See Section 23 05 00 – Common Work Results for HVAC for general training requirements.
B. Contractor to provide factory authorized representative and/or field personnel knowledgeable with the operations, maintenance and troubleshooting of the system and/or components defined within this section for a minimum period of 16 hours.
C. Provide two follow-up visits for troubleshooting and instruction, one six months after substantial completion and the other at the end of nine months of warranty period. Length of each visit to be not less than 8 hours or the time necessary to provide required information and complete troubleshooting and inspection activity for all controls installed under this section. Coordinate the visit with the owner and provide an inspection report to the owner of any deficiencies found.

END OF SECTION

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SECTION 23 09 93
SEQUENCE OF OPERATION FOR HVAC CONTROLS

PART 1 – GENERAL

1.01 SCOPE OF WORK
A. Unless noted otherwise, the HVAC Contractor shall provide all labor and materials for a complete control system in this specification.

1.02 SECTION INCLUDES
A. This section includes control sequences for HVAC equipment as well as equipment furnished by others that may need monitoring or control. Included are the following topics:
   1. General Control Sequence Items
   2. Plumbing Systems Monitoring
   3. Equipment Specific Control Sequences

1.03 RELATED WORK
A. Applicable provisions of Division 1 govern work under this Section.
B. Section 23 05 00 – Common Work Results for HVAC
C. Section 23 05 14 – Variable Frequency Drives
D. Section 23 05 93 – Testing, Adjusting, and Balancing for HVAC – Coordination
E. Section 23 09 14 – Electric Instrumentation and Control Devices for HVAC
F. Section 23 09 23 – Direct Digital Control System for HVAC
G. Division 23 – HVAC - Equipment provided to be controlled or monitored
H. Division 26 – Electrical - Equipment provided to be controlled or monitored
I. Division 28 – Electronic Safety and Security

1.04 SUBMITTALS
A. Refer to Division 1, Section 23 05 00 – Common Work Results for HVAC, Section 23 09 14 – Pneumatic and Electric Instrumentation and Control Devices for HVAC and Section 23 09 23 – Direct Digital Control System for HVAC for descriptions of what should be included in the submittals.
B. Provide a complete narrative of the sequence of operations for equipment that is controlled through the DDC system. Provide a complete narrative of the sequence of operation for equipment that is controlled directly from that equipment (without control logic through the DDC system). The narrative of the sequence of operation shall not be a verbatim copy of the sequences contained herein but shall reflect the actual operation as applied by the contractor.

1.05 DESIGN CRITERIA
A. Reference Section 23 09 14 – Pneumatic and Electric Instrumentation and Control Devices for HVAC.

1.06 OPERATION AND MAINTENANCE DATA
A. All operations and maintenance data shall comply with the submission and content requirements specified in Section 23 05 00 – Common Work Results for HVAC.

1.07 REFERENCE
A. For the following work, refer to Section 23 09 14 – Pneumatic and Electric Instrumentation and Control Devices for HVAC.
   1. Furnishing and installing all field devices, including electronic sensors for the DDC of this section, equipment, and all related field wiring, interlocking control wiring between equipment, sensor mounting, etc., that is covered in that section.
   2. Motorized control dampers and actuators, thermowells (temperature sensing wells), automatic control valves and their actuators.

1.08 DESCRIPTION OF WORK

A. Control sequences are hereby defined as the manner and method by which automatic controls function. Requirements for each type of operation are specified in this section.
B. Operation equipment, devices and system components required for automatic control systems are specified in other Division 23 control sections of these specifications.
C. All temperature, humidity, and pressure sensing, and all other control signal transportation for the control sequences shall be furnished under Section 23 09 14. All electronic, and electric input/output signals shall be extended under Section 23 09 14, with adequate lead length for termination within the appropriate control panel being provided under Section 23 09 23.
D. Sequences for equipment controlled by Direct Digital Controls (DDC) as specified are accomplished by hardware and software provided under Section 23 09 23. Sequences for equipment controlled by pneumatic or electric self-contained controls are accomplished by hardware provided under Section 23 09 14.

PART 2 – PRODUCTS

2.01 Not applicable to this section – reference Sections 23 09 23 and 23 09 14 for product descriptions.

PART 3 – EXECUTION

3.01 CONTROL SEQUENCES

A. General Control Sequence Items:
   1. Setpoints:
      a. All setpoints indicated in the control specification are to be adjustable. The setpoints shall be readily available to be modified in the mechanical system software system summary (either textual or graphic based) and under the same software level as hardware points. Some less used setpoints may be provided on a lower software level, if requested by the Owner for clarity. The setpoints indicated herein are only specified as a calculated starting point (or initial system operation). It is expected that setpoint adjustments and control loop tuning shall be required to provide optimum system operation based on requirements of the building. The control contractor shall work with the balancing contractor and the Owner to provide the final system setpoint adjustments and control loop tuning after the system is in operation and building is in use. Document all final setpoints on the as-built control drawings. Any questions regarding the intended operation of the HVAC equipment and control systems shall be referred to the HVAC design engineer through the appropriate construction communication process. The following setpoints should be used as initial setpoints unless otherwise specified in the individual control sequences:
         1) Occupied Space Terminal Unit Heating: 68º F
         2) Occupied Space Terminal Unit Cooling: 76º F
         3) Entry Way Heating: 60° F
         4) Mechanical or Unoccupied Space Cooling/Ventilation: 82º F
         5) Mechanical or Unoccupied Space Heating: 60º F
B. Anti-Cycling:
   1. When HVAC equipment or a sequence is specified to be started and stopped by a temperature, humidity, pressure setpoint or any other controlled variable, there shall be an adjustable differential setpoint that shall be set to prevent short cycling of the systems and equipment due to minor changes in the controlled variable. Temperature differential setpoints shall be set at 2º F and non-temperature setpoints shall be set at 10% of the controlled range unless otherwise specified. Setpoints shall indicate at when the process should be turned on. Heating and cooling differentials shall be set for above setpoint and will be used to turn the process off. For example, an economizer sequence called to switch at 68º F, would turn on at 68º F and off at 70º F since it is a cooling function. A heating lockout setpoint of 50º F would turn on heating control at 50º F and off at 52º F Non-temperature differentials shall be set above setpoint if the setpoint is indicating a minimum value or below setpoint if the setpoint is indicating a maximum value. Provide

minimum runtime timers for loads that are cycled to prevent over-cycling. Timers shall be set as specified or as needed to prevent damage or excessive wear to the equipment. Unless otherwise specified in the individual control sequences, fans and pumps shall have a minimum runtime on timers of 15 minutes (adj.) and off timers of 5 minutes (adj.). Safeties shall override runtime timers.

C. Deadbands:
   1. Provide deadbands for all DDC control loops to prevent constant hunting of output signals to controlled devices. Deadbands shall be set to provide adequate control around setpoint as follows unless otherwise specified in the individual control sequences:
      a. Temperature Control: ±0.5º F
      b. Humidity Control: ±1% RH
      c. Airflow Control: ±2% of total flow
      d. AHU Static Pressure Control: ±0.01 in. w.c.

D. Alarms: Provide all alarmed points with adjustable time delays to prevent nuisance tripping under normal operation and on equipment start-up. For all commanded outputs that have status feedback, provide an alarm that will indicate the commanded output is not in its commanded state. Provide alarms on all points as indicated on point charts. For existing automations systems, add/delete what is called for on the point charts after consultation with Owner to provide consistent alarming throughout the automation system.

E. Equipment Start/Stop Failure States: All start/stop points for equipment shall utilize normally open contacts unless called out specifically in the individual control sequences.

F. Lead/Lag Sequencing: For sequences that call for lead/lag of equipment connected to building automation systems, the lead device shall be able to be chosen through a selectable day of the week and time of day through the building automation system. Coordinate with the Owner for scheduling switchover and frequency. Unless otherwise directed, switchover shall occur at 10AM Tuesday and shall rotate the lead device on a weekly cycle rotating through all devices sequentially. For standalone lead/lag sequence controllers (non-DDC), the lead device shall be selected by a switch on the panel face.

G. Variable Frequency Drive (VFD) Motor Run Status: Use the VFD programmable relay dry contact output specified to be provided with the VFD under Section 23 05 14 – Variable Frequency Drives to prove motor run status and detect belt loss or coupling break. If a bypass contactor is provided with the VFD, provide an adjustable current switch and wire it in parallel with the VFD output for proving motor status.

H. VFD Bypass & Safety Interlocks: VFD's equipped with bypass starters shall be interlocked so that the start/stop and safety circuits that are called out for VFD operation shall be functional when the VFD is indexed to the bypass starter mode. Unless otherwise specified in the sequence below, the switch from inverter to bypass starter modes shall be through a manual switch provided on the VFD/bypass starter package.

I. VFD Minimum Speed & Ramp Timers: The VFD start-up technician shall work with the DDC Temperature Control Contractor to determine the minimum speed required for the motor controlled by the VFD to provide cooling of the motor as installed to prevent heat related problems. This minimum speed shall be set in the VFD controller. The VFD start-up technician shall work with the DDC Temperature Control Contractor to set the acceleration and deceleration timers in the VFD controller at 30 seconds for motors less than 40 HP and 60 seconds for motors 40 HP and greater.

J. Current Switch Setup: When current switches are used for proving fan or pump status, they shall be set up so that they will detect belt or coupling loss by the reduction in current draw on loss of coupled load. The current switch set up shall be redone by the Temperature Control Contractor after the balancer is complete.

K. Damper Interlocks for Fans with Starters: For fan systems with magnetic starters and shutoff dampers specified with end switches, the damper interlock shall be hardwired in such a way that the damper shall open if the fan starter hand / off / auto switch is in the hand or in the auto position and being called to start. After the damper end switch has proven the damper open, a hardwire interlock from the end switch to the starter holding coil for the fan shall cause the fan to start. For fan systems that are ducted in parallel, see specific sequence for fan system on interlock requirements.

L. Damper Interlocks for Fans with VFD's:
   1. For fan systems with VFD's and shutoff dampers specified with end switches, the damper end switches shall be hardwire interlocked to the safety circuit(s) of the VFD to prevent the fan from starting until the damper is proven open. This interlock shall prevent the fan from running in either the VFD or bypass (if provided) mode. The damper end switch shall also be monitored by the DDC system. For fan systems that are ducted in parallel, see specific sequence for fan system on additional interlock requirements.
   2. For fan systems with VFD's and shutoff dampers specified with end switches, hardwire interlock the shutoff damper with the fan VFD. When the fan is remotely or locally commanded to start, VFD contacts shall energize outside air damper actuator to open damper. The damper position end switch shall be wired to run permissive input on the VFD and enable the VFD to start when the damper position end switch provides the damper is open. This operation shall be provided for VFD and bypass operation if the VFD is provided with a bypass. The damper end switch shall also be monitored by the DDC system. For fan systems that are ducted in parallel, see specific sequence for fan system on additional interlock requirements.

M. Smoke Damper Control:
   1. Smoke dampers provided in ducts are required to close by building code in the event their associated smoke detectors are in alarm or if the associated duct smoke detector requires a minimum velocity to operate and the associated fan(s) that supply, return, or exhaust air through them are shutdown.
   2. For software interlocks of smoke dampers to the fan systems, the smoke dampers will be commanded open and closed on fan status through the DDC smoke damper control output
   3. For fan systems with safety circuit hardwire interlocks and fan fails to start after an appropriate time delay (not longer than five minutes), smoke dampers shall close through the DDC smoke damper control output, the fan shall be latched off, and an alarm sent through the DDC system. A software reset point and a momentary pushbutton located at the temperature control panel for the associated fan system shall be provided to reset the fan system. On fan system start-up, a time delay shall allow the dampers to open before the fan is started. All necessary software and hardware interlocks shall be provided to perform these functions. See individual fan system control sequences for the type of smoke damper interlock to use and more details on how this should be accomplished. The smoke dampers shall be hardwire interlocked to the associated fire alarm control module to close whenever the fire alarm control module indicates an alarm to shutdown the associated AHU.
   4. Alarms shall be provided for each smoke damper by the Temperature Control Contractor. The alarm shall be generated when the smoke damper is not in its commanded position after the appropriate time delay to allow for the smoke damper to actuate fully. Alarms shall be provided regardless if the smoke damper command is from the DDC system or fire alarm system. Binary inputs to the DDC system from the fire alarm system devices commanding the dampers shall be provided for to allow for all required alarming.

N. Fan Interlocking:
   1. Provide interlocks between supply and return or exhaust fan systems as scheduled on the plans or called out in individual control sequences. If DDC controlled, interlocks shall be done through DDC start/stop points unless otherwise specified in individual control sequences. If not DDC controlled, interlocks shall be accomplished via hardwire interlocks between fan starters or VFD's.

O. Thermostats and Sensors: All devices and equipment including terminal units, specified to be controlled in a control sequence by a thermostat or sensor, shall be provided with a thermostat or sensor, whether or not the device is indicated on the plans. Consult the HVAC design engineer for the thermostat or sensor location.

P. Original Equipment Manufacturer (OEM) Controller DDC Integration:
   1. Provide DDC programming to define all equipment integral input/output points, setpoints, data points, calculations, etc. that are available through the manufacturer's communication interface. Consult with the Owner DDC operations personnel to determine if some of the points should be omitted (for clarity or lack of value).

Q. Weekly Scheduling: Provide scheduling of DDC terminal units in groups based on occupancy. Work with the Owner to determine how many groups are required and which zones should be included. Individual terminal units shall be able to receive temporary schedules that will override the group schedules. Temporary override buttons at the zone sensor (where specified on point charts) shall override the scheduling to occupied. When groups that consist of more than 20% of terminal units are indexed to occupied, the associated air handling unit shall start if not already running.

R. Calculated Data Points:
   1. Provide calculated data points for actual dirty pressure drop for all variable volume air handling units with supply flow measurement based on the following equation:
      a. Actual Dirty Filter ΔP = (Measured Supply CFM/Design CFM)^2 x Design Dirty Filter ΔP
   2. Provide a calculated data point for outside airflow for all fans that have return and outside air mixing dampers and the points required to allow for the following equation:
      a. Outside Airflow = Supply CFM x (MAT-RAT)/(OAT-RAT)
   3. Where Supply CFM is measured either on variable volume fans or as balanced on constant volume units, MAT is Mixed Air Temperature, RAT is Return Air Temperature, and OAT is Outside Air Temperature. This point is designed as a check for outside air flow stations accuracy and outside air ventilation minimum damper positions. It should be noted that the accuracy of the calculated outside airflow will diminish as outside air temperature approaches return air temperature. It should be used as a check only when the RAT and OAT are greater than 20° F and the accuracy of the RAT and OAT temperature sensors are assured.

3.02 PLUMBING SYSTEMS MONITORING

A. Refer to drawings for additional plumbing system monitoring requirements.

3.03 EQUIPMENT SPECIFIC CONTROL SEQUENCES

A. Refer to the project drawings for control sequences.

END OF SECTION

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SECTION 23 11 00
FACILITY FUEL PIPING

PART 1 – GENERAL

1.01 SCOPE OF WORK
A. HVAC Contractor to provide fuel piping as specified and indicated on the drawings.

1.02 SECTION INCLUDES
A. This section contains specifications for fuel pipe and fuel pipe fittings for this project. Included are the following topics:
   1. Natural Gas
   2. Vents and Relief Valves
   3. Unions and Flanges
   4. Valves
   5. Piping System Leak Tests

1.03 RELATED WORK
A. Applicable provisions of Division 1 govern work under this section.
B. Section 23 05 15 – Piping Specialties
C. Section 23 05 23 – General-Duty Valves for HVAC Piping
D. Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment
E. Section 23 25 00 – HVAC Water Treatment.

1.04 SUBMITTALS
A. Refer to Section 23 05 00 – Common Work Results for HVAC, Submittals. In addition to the general content specified under Section 23 05 00 – Common Work Results for HVAC, supply the following submittals:
   1. Natural Gas
   2. Vents and Relief Valves
   3. Unions and Flanges
   4. Valves
   5. Piping System Leak Tests
B. Contractor shall submit schedule indicating the ASTM specification number of the pipe being proposed along with its type and grade and sufficient information to indicate the type and rating of fittings for each service.
C. Type E or S Steel Pipe: Mill certification papers, also known as material test reports, for the pipe furnished for this project, in English. Heat numbers on these papers to match the heat numbers stenciled on the pipe. Chemical analysis indicated on the mill certification papers to meet or exceed the requirements of the referenced ASTM specification.

1.05 REFERENCE STANDARDS
A. ANSI B16.3 — Malleable Iron Threaded Fittings
B. API RP 1632 — Cathodic Protection of Underground Petroleum Storage Tanks and Piping Systems; American Petroleum Institute ; 1996 (Reapproved 2002).
C. ASME (BPV) — Boiler and Pressure Vessel Code; The American Society of Mechanical Engineers; 2007.
D. ASME (BPV IX) — Boiler and Pressure Vessel Code, Section IX - Welding and Brazing Qualifications; The American Society of Mechanical Engineers ; 2010.
E. ASME B16.3 — Malleable Iron Threaded Fittings; The American Society of Mechanical Engineers; 1998 (R2006).
F. ASME B16.18 — Cast Copper Alloy Solder-Joint Pressure Fittings; The American Society of Mechanical Engineers ; 2001 (R2005) (ANSI B16.18).

G.	ASME B16.22	Wrought Copper and Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers ; 2001 (R2005).
H.	ASME B16.26	Cast Copper Alloy Fittings for Flared Copper Tubes; The American Society of Mechanical Engineers ; 2006.
I.	ASME B31.1	Power Piping; The American Society of Mechanical Engineers ; 2007 (ANSI/ASME B31.1).
J.	ASME B36.10M	Welded and Seamless Wrought Steel Pipe; The American Society of Mechanical Engineers ; 2004.
K.	ASTM A53/A53M	Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless ; 2010.
L.	ASTM A123/A123M	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products ; 2009.
M.	ASTM A234/A234M	Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service ; 2011.
N.	ASTM B32	Standard Specification for Solder Metal ; 2008.
O.	ASTM B88	Standard Specification for Seamless Copper Water Tube ; 2009.
P.	ASTM B88M	Standard Specification for Seamless Copper Water Tube (Metric) ; 2005.
Q.	ASTM D2310	Standard Classification for Machine-Made "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe ; 2006.
R.	ASTM D2996	Standard Specification for Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe ; 2001 (Reapproved 2007).
S.	AWS A5.8/A5.8M	Specification for Filler Metals for Brazing and Braze Welding; American Welding Society ; 2004 and errata.
T.	AWWA C105/A21.5	Polyethylene Encasement for Ductile-Iron Pipe Systems; American Water Works Association ; 2005 (ANSI/AWWA C105/A21.5).
U.	MSS SP-58	Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. ; 2009.
V.	MSS SP-80	Bronze Gate, Globe, Angle and Check Valves; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. ; 2008.
W.	MSS SP-110	Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. ; 1996.
X.	NACE SP0169	Control of External Corrosion on Underground or Submerged Metallic Piping Systems; NACE International ; 2007.

1.06 QUALITY ASSURANCE

A. Order all Type E and Type S steel pipe with heat numbers rolled, stamped, or stenciled to each length or each bundle, depending on the size of the pipe, and in accordance with the appropriate ASTM specification.
B. Any installed material not meeting the specification requirements must be replaced with material that meets these specifications without additional cost to the Owner.

1.07 DESIGN CRITERIA

A. Use only new material, free of defects, rust and scale, and meeting the latest revision of ASTM specifications as listed in this specification.
B. Construct all piping for the highest pressures and temperatures in the respective system in accordance with ANSI B31, but not less than 125 psig unless specifically indicated otherwise.
C. Non-metallic piping will be acceptable only for the services indicated. It will not be acceptable in occupied spaces and ventilation plenum spaces, including plenum ceilings.
D. Where weld fittings or mechanical grooved fittings are used, use only long radius elbows having a centerline radius of 1.5 pipe diameters.
E. Where ASTM A53 grade A pipe is specified, ASTM A53 grade B pipe may be substituted at Contractor's option. Where the grade or type is not specified, Contractor may choose from those commercially available.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Promptly inspect shipments to ensure that the material is undamaged and complies with specifications.
B. Cover pipe to eliminate rust and corrosion while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade. Protect pipe, tube, and fitting ends so they are not damaged. Where end caps are provided or specified, take precautions so the caps remain in place.
C. Offsite storage agreements will not relieve the contractor from using proper storage techniques.
D. Storage and protection methods must allow inspection to verify products.

1.09 WELDER QUALIFICATIONS

A. Before any metallic welding is performed, Contractor to submit his Standard Welding Procedure Specification together with the Procedure Qualification Record as required by Section IX of the ASME Boiler and Pressure Vessel Code and/or the National Certified Pipe Welding Bureau.
B. Before any polyethylene fusion welding is performed, Contractor to submit certification that the welders to be used on this project have successfully demonstrated proper welding procedures in accordance with the Code of Federal Regulations, Title 49, Part 192, Section 192.285.
C. The A/E or owner reserves the right to test the work of any welder employed on the project, at the Contractor's expense. If the work of the welder is found to be unsatisfactory, the welder shall be prevented from doing further welding on the project.

1.10 NATURAL GAS SERVICE

A. All charges for the gas service as shown on the plans, including the connection from the main in the street or other location to the gas meter, shall be paid by this Contractor, including setting of gas meter(s) and all work performed by the gas company.

PART 2 - PRODUCTS

2.01 NATURAL GAS

A. 2" and Smaller: ASTM A53, type E or S, standard weight (schedule 40) black steel pipe with ASTM A197/ANSI B16.3 class 150 black malleable iron threaded fittings or ASTM A234 grade WPB/ANSI B16.9 standard weight, seamless, carbon steel weld fittings.
B. 2-1/2" and Larger: ASTM A53, type E or S, standard weight black steel pipe with ASTM A234 grade WPB/ANSI B16.9 standard weight, seamless, carbon steel weld fittings.

2.02 VENTS AND RELIEF VALVES

A. Use pipe and pipe fittings as specified for the system to which the relief valve or vent is connected.

2.03 UNIONS AND FLANGES

A. 2" and Smaller: ASTM A197/ANSI B16.3 malleable iron unions with brass seats. Use black malleable iron on black steel piping and galvanized malleable iron on galvanized steel piping. Use unions of a pressure class equal to or higher than that specified for the fittings of the respective piping service but not less than 250 psi. Copper tube: 250 psi bronze unions with brazed joints.
B. 2-1/2" and Larger: ASTM A181 or A105, grade 1 hot forged steel flanges of threaded, welding and of a pressure class compatible with that specified for valves, piping specialties and fittings of the respective piping service. Flanges smaller than 2-1/2" may be used as needed for connecting to equipment and piping specialties. Use raised face flanges ANSI B16.5 for mating with other raised face flanges on equipment with flat ring or full face gaskets. Use ANSI B16.1 flat face flanges with full face gaskets for mating with other flat face flanges on equipment. Copper tube: 250 psi slip on bronze flanges; 1/16th inch thick preformed neoprene gaskets.

2.04 VALVES

A. Refer to specification section 23 05 23 for General Duty Valves for HVAC.

PART 3 – EXECUTION

3.01 PREPARATION

A. Remove all foreign material from interior and exterior of pipe and fittings.

3.02 ERECTION

A. Install all piping parallel to building walls and ceilings and at heights which do not obstruct any portion of a window, doorway, stairway, or passageway. Where interferences develop in the field, offset or reroute piping as required to clear such interferences. In all cases, consult drawings for exact location of pipe spaces, ceiling heights, door and window openings, or other architectural details before installing piping.
B. Provide anchors, expansion joints, swing joints and/or expansion loops so that piping may expand and contract without damage to itself, equipment, or building.
C. Mitered ells, notched tees, and orange peel reducers are not acceptable. On threaded piping, bushings are not acceptable.
D. "Weldolets" and "Threadolets" may be used for branch takeoffs up to one-half (1/2) the diameter of the main.
E. Do not route piping through transformer vaults or above transformers, panelboards, or switchboards, including the required service space for this equipment, unless the piping is serving this equipment
F. Install all valves, and piping specialties, including items furnished by others, as specified and/or detailed. Make connections to all equipment installed by others where that equipment requires the piping services indicated in this section.

3.03 WELDED PIPE JOINTS

A. Make all welded joints by fusion welding in accordance with ASME Codes, ANSI B31, and State Codes where applicable.
B. Electrodes shall be Lincoln, or approved equal, with coating and diameter as recommended by the manufacturer for the type and thickness of work being done.

3.04 THREADED PIPE JOINTS

A. Use a Teflon based thread lubricant or Teflon tape when making joints; no hard setting pipe thread cement or caulking will be allowed.

3.05 NATURAL GAS

A. Pitch horizontal piping down 1" in 60 feet in the direction of flow. Install a 4" minimum depth dirt leg at the bottom of each vertical run and at each appliance. When installing mains and branches, cap gas tight each tee or pipe end which will not be immediately extended. All branch connections to the main shall be from the top or side of the main.
B. Do not install gas pipe in a ventilation air plenum.
C. If an above ground vent terminates in an area subject to snow accumulation, terminate the line at least five feet above grade.
D. Install a shut off valve at each appliance. Provide a valved connection at the main for equipment and appliances furnished by others.
E. Piping through a roof shall be run through an approved roof penetration with flashing and counter flashing.
F. Each gas pressure reducing valve vent and relief valve vent shall be run separately to a point outside of the building, terminated with a screened vent cap, and located according to gas utility regulations.
G. Clean all welded piping before all regulators and control valves. Test by placing target cloth over piping and blow with compressed air. Clean piping until target cloth is clean and free of debris.

3.06 VENTS AND RELIEF VALVES

A. Install vent and relief valve discharge lines as indicated on the drawings, as detailed, and as specified for each specific valve or piping specialty item. In no event is a termination to occur less than six feet above a roof line.

3.07 UNIONS AND FLANGES

A. Install a union or flange, as required, at each automatic control valve and at each piping specialty or piece of equipment which may require removal for maintenance, repair, or replacement. Where a valve is located at a piece of equipment, locate the flange or union connection on the equipment side of the valve. Concealed unions or flanges are not acceptable.

3.08 PIPING SYSTEM LEAK TESTS

A. Verify that the piping system being tested is fully connected to all components and that all equipment is properly installed, wired, and ready for operation. If required for the additional pressure load under test, provide temporary restraints at expansion joints or isolate them during the test. Verify that hangers can withstand any additional weight load that may be imposed by the test.
B. Provide all piping, fittings, blind flanges, and equipment to perform the testing.
C. Conduct pressure test with test medium of air or water unless specifically indicated. Minimum test time is indicated in the table below; additional time may be necessary to conduct an examination for leakage. Each test must be witnessed by the Owner's representative. If leaks are found, repair the area with new materials and repeat the test; caulking will not be acceptable.
D. Do not insulate pipe until it has been successfully tested.
E. For hydrostatic tests, use clean water and remove all air from the piping being tested by means of air vents or loosening of flanges/unions. Measure and record test pressure at the high point in the system.
F. For air tests, gradually increase the pressure to not more than one half of the test pressure; then increase the pressure in steps of approximately one-tenth of the test pressure until the required test pressure is reached. Examine all joints and connections with a soap bubble solution or equivalent method. The piping system exclusive of possible localized instances at pump or valve packing shall show no evidence of leaking. After testing is complete, slowly release the pressure in a safe manner.
G. Measure natural gas system test pressure with a water manometer or an equivalent device calibrated in increments not greater than 0.1 inch water column. System will not be approved until it can be demonstrated that there is no measurable loss of test pressure during the test period.

System	Pressure	Medium	Duration
Natural gas	100 psig	Air	24 hr.

H. All-pressure-tests-are-to-be-documented-on-attached-form-included-in-this-specification.
I. On piping that cannot be tested because of connection to an active line, provide temporary blind flanges and hydrostatically test new section of piping. After completion of test, remove temporary flanges and make final connections to piping. Die penetrate test pass weld or x-ray the piping that was not hydrostatically tested up to the active system.

END OF SECTION

PIPING SYSTEM TEST REPORT

Date Submitted: _____

Project Name: _____

Location: _____

Project No:_____

Contractor:_____

☐ **HVAC** ☐ **Refrigeration** ☐ **Controls**

☐ **Power Plant** ☐ **Plumbing** ☐ **Sprinkler**

Test Medium: ☐ **Air** ☐ **Water** ☐ **Other**_____

Test performed per specification section No. _____

Specified Test Duration _____ **Hours** **Specified Test Pressure** _____**PSIG**

System Identification: _____

Describe Location: _____

_____

Test Date: _____

Start Test Time: _____ **Initial Pressure:** _____**PSIG**

Stop Test Time: _____ **Final Pressure:** _____**PSIG**

Tested By: _____ **Witnessed By:** _____

Title: _____ **Title:** _____

Signed: _____ **Signed:** _____

Date: _____ **Date:** _____

Comments: _____

_____

_____

_____

SECTION 23 21 13
HYDRONIC PIPING

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Contractor shall provide all labor and materials for a complete system in this specification.

1.02 SECTION INCLUDES

A. This section contains specifications for all HVAC hydronic pipe and pipe fittings for this project. Included are the following topics:
   1. Heating Hot Water
   2. Makeup Water
   3. Chemical Treatment
   4. Vents and Relief Valves
   5. Cooling Coil Condensation Drains
   6. Unions and Flanges
   7. Gaskets
   8. Mechanical Grooved Pipe Connections

1.03 RELATED WORK

A. Applicable provisions of Division 1 govern work under this section.
B. Section 23 05 00 – Common Work Results for HVAC
C. Section 23 05 15 - Piping Specialties
D. Section 23 05 23 - General-Duty Valves for HVAC Piping
E. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment
F. Section 23 07 00 - HVAC Insulation
G. Section 23 25 00 - HVAC Water Treatment.

1.04 SUBMITTALS

A. Refer to Section 23 05 00 – Common Work Results for HVAC. In addition to the general content specified under Section 23 05 00 – Common Work Results for HVAC, supply the following submittals:
   1. Heating Hot Water
   2. Makeup Water
   3. Chemical Treatment
   4. Vents and Relief Valves
   5. Cooling Coil Condensation Drains
   6. Unions and Flanges
   7. Gaskets
   8. Mechanical Grooved Pipe Connections
B. Contractor shall submit schedule indicating the ASTM specification number of the pipe being proposed along with its type and grade and sufficient information to indicate the type and rating of fittings for each service.
C. Type F Steel Pipe: Statement from manufacturer on their letterhead that the pipe furnished meets the ASTM specification contained in this section.
D. Type E Or S Steel Pipe: Mill certification papers, also known as material test reports, for the pipe furnished for this project, in English. Heat numbers on these papers to match the heat numbers stenciled on the pipe. Chemical analysis indicated on the mill certification papers to meet or exceed the requirements of the referenced ASTM specification.
E. Copper Tube: Statement from manufacturer on their letterhead that the pipe furnished meets the ASTM specification contained in this section.

1.05 REFERENCE STANDARDS

A. ANSI B16.3 Malleable Iron Threaded Fittings
B. ANSI B16.4 Cast Iron Threaded Fittings
C. ANSI B16.5 Pipe Flanges and Flanged Fittings
D. ANSI B16.22 Wrought Copper and Wrought Copper Alloy Solder Joint Pressure Fittings
E. ASTM A53 Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless
F. ASTM A74 Cast Iron Soil Pipe and Fittings
G. ASTM A105 Forgings, Carbon Steel, for Piping Components
H. ASTM A126 Gray Cast Iron Castings for Valves, Flanges, and Pipe Fittings
I. ASTM A181 Forgings, Carbon Steel for General Purpose Piping
J. ASTM A197 Cupola Malleable Iron
K. ASTM A234 Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
L. ASTM A380 Practice for Cleaning and Descaling Stainless Steel Parts, Equipment, and Systems
M. ASTM B75 Seamless Copper Tube
N. ASTM B88 Seamless Copper Water Tube

1.06 QUALITY ASSURANCE

A. Order all Type E and Type S steel pipe with heat numbers rolled, stamped, or stenciled to each length or each bundle, depending on the size of the pipe, and in accordance with the appropriate ASTM specification.
B. Any installed material not meeting the specification requirements must be replaced with material that meets these specifications without additional cost to the Owner.
C. All hydronic piping shall be manufactured in the United States.

1.07 DESIGN CRITERIA

A. Use only new material, free of defects, rust and scale, and meeting the latest revision of ASTM specifications as listed in this specification.
B. Construct all piping for the highest pressures and temperatures in the respective system in accordance with ANSI B31, but not less than 125 psig unless specifically indicated otherwise.
C. Where weld fittings or mechanical grooved fittings are used, use only long radius elbows having a centerline radius of 1.5 pipe diameters.
D. Where ASTM A53 type F pipe is specified, ASTM A53 grade A type E or S, or ASTM A53 grade B type E or S may be substituted at Contractor's option. Where ASTM A53 grade A pipe is specified, ASTM A53 grade B pipe may be substituted at Contractor's option. Where the grade or type is not specified, Contractor may choose from those commercially available.
E. Where ASTM B88, type L hard temper copper tubing is specified, ASTM B88, type K hard temper copper tubing may be substituted at Contractor's option.

1.08 DELIVERY, STORAGE AND HANDLING

A. Promptly inspect shipments to ensure material is undamaged and complies with specifications.
B. Cover pipe to eliminate rust and corrosion while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade. Protect pipe, tube, and fitting ends so they are not damaged. Where end caps are provided or specified, take precautions so the caps remain in place. Protect fittings, flanges, and unions by storage inside or by durable, waterproof, above ground packaging.
C. Offsite storage agreements will not relieve the contractor from using proper storage techniques.
D. Storage and protection methods must allow inspection to verify products.

1.09 WELDER QUALIFICATIONS

A. Before any metallic welding is performed, the Contractor shall submit his Standard Welding Procedure Specifications, Procedure Qualification Records and Qualification Test Records for each Welder along with associated continuity records to demonstrate compliance with ASME Section IX, paragraph QW-322.

B. The Contractor shall maintain a complete set of welder qualification documents at the jobsite, including Test Records and Continuity Records for each welder.
C. The A/E or owner reserves the right to test the work of any welder employed on the project, at the Contractor's expense. Testing will include a visual examination of the pipe and weld and may include radiography of any suspect welds. If the work of the welder is found to be unsatisfactory, the welder shall be prevented from doing further welding on the project. Any welds deemed unacceptable will be repaired at the contractor's expense.

PART 2 – PRODUCTS

2.01 HEATING HOT WATER

A. 2" and Smaller: ASTM A53, type F, standard weight (schedule 40) black steel pipe with ASTM A126/ANSI B16.4, class 125, standard weight cast iron threaded fittings.
B. 2-1/2" and Larger: ASTM A53, standard weight (schedule 40) black steel pipe with ASTM A234 grade WPB/ANSI B16.9 standard weight, seamless, carbon steel weld fittings.
C. Contractor may use ASTM B88 seamless, type L, hard temper copper tube with ANSI B16.22 wrought copper solder-joint fittings in lieu of steel pipe for all sizes. Mechanically formed tee fittings may be used in lieu of wrought copper solder-joint tee fittings for branch takeoff up to one-half (1/2) the diameter of the main.

2.02 MAKEUP WATER

A. Extend from where left by the Plumbing Contractor with the same materials.

2.03 CHEMICAL TREATMENT

A. Use pipe and pipe fittings as specified for the system to which the chemical treatment piping is connected. Plastic pipe furnished with the chemical treatment materials may also be used if its pressure/temperature rating is acceptable for the service.

2.04 VENTS AND RELIEF VALVES

A. Use pipe and pipe fittings as specified for the system to which the relief valve or vent is connected.

2.05 COOLING COIL CONDENSATION DRAINS

A. ASTM B88, type L hard temper copper tubing with ASTM B145/ANSI B16.23 cast red bronze or ASTM B75/ANSI B16.29 wrought solder-type drainage fittings.

2.06 UNIONS AND FLANGES

A. 2" and Smaller: ASTM A197/ANSI B16.3 malleable iron unions with brass seats. Use black malleable iron on black steel piping and galvanized malleable iron on galvanized steel piping. Use ANSI B16.18 cast copper alloy unions on copper piping. Use unions of a pressure class equal to or higher than that specified for fittings of the respective piping service but not less than 250 psi.
B. 2-1/2" and Larger: ASTM A181 or A105, grade 1 hot forged steel flanges of threaded, welding and of a pressure class compatible with that specified for valves, piping specialties and fittings of the respective piping service. Flanges smaller than 2-1/2" may be used as needed for connecting to equipment and piping specialties. Use raised face flanges ANSI B16.5 for mating with other raised face flanges on equipment with flat ring or full face gaskets. Use ANSI B16.1 flat face flanges with full face gaskets for mating with other flat face flanges on equipment.
C. Dielectric Connections: Union or waterway fitting with water impervious isolation barrier and one galvanized or plated steel end and one copper tube end, end types to match pipe joint types used.
D. Dielectric Unions:
   1. Manufacturers: Capitol Manufacturing Company, Hart Industries, Watts Regulator Company, Zurn Plumbing Products Group, Substitutions: See Section 01 60 00 - Product Requirements.

2. Unions:
   a. ASME B16.39, Class 250
   b. Body and Nut: Steel with galvanized coating
   c. Insulator: Nylon
   d. Tailpiece: Brass
   e. Gaskets: EPDM
3. Dielectric unions shall be used when joining pipes of dissimilar metals in piping 2" (50 mm) and under. Connections shall be threaded and/or soldered to conform to materials being joined. Gasket and bushing material for domestic water and chilled water systems shall be rated for fluid temperatures of 180° F (82° C) and under.

E. Dielectric Flanges Kits:
1. Manufacturers: Advance Products and Systems, Inc., Calpico, Inc., Pipeline Seal and Insulator, Inc., Substitutions: See Section 01 60 0 0- Product Requirements.
2. Flange:
   a. ASME B16.5, Class 150 or Class 300 weld neck flange to suit service pressure/temperature requirements.
   b. Insulating Sleeves: Phenolic or polyethylene
   c. Washers: Phenolic with steel backing washers
   d. Bolts and Nuts: Flange bolts an nuts shall conform to the requirements of ASME B31.9 – Building Services Piping
   e. Gaskets: Neoprene or phenolic
3. Dielectric flanges shall be used when joining pipes of dissimilar metals in piping 2 ½" (63 mm) and larger. Connections shall be threaded and/or soldered to conform to materials being joined. Gasket and bushing material for domestic water and chilled water systems shall be rated for fluid temperatures of 180° F (82° C) and under.
4. Dielectric couplings may be used in lieu of dielectric unions or flanges in piping ½" through 3" (15 mm through 75 mm). Where dielectric couplings are used, a union shall be placed with 6" (150 mm) of coupling. Dielectric couplings shall not be used where fluid temperature exceeds 200° F (93° C).
5. Dielectric unions, flanges and couplings shall be manufactured and assembled domestically.

2.07 GASKETS

A. Water Systems: Branded, compressed, non-asbestos sheet gaskets. Klingersil C4401, Garlock 3000, JM Clipper 978.

2.08 MECHANICAL GROOVED PIPE CONNECTIONS

A. Manufacturers: Victaulic, Grinnell, Central
B. Mechanical grooved pipe couplings and fittings may be used with steel pipe on the systems indicated below. Either cut-groove or equivalent roll-groove products, including gaskets, are acceptable providing the system temperature and pressure requirements are met. Where malleable iron fittings are indicated, they shall conform to ASTM A47. Where forged steel fittings are indicated, they shall conform to ASTM A106, Grade B. Where fabricated steel fittings are indicated, they shall conform to ASTM A53, type F in sizes 3/4" through 1-1/2" and type E or S, grade B in sizes 2" through 20". Do not use fabricated fittings where malleable iron or forged steel fittings are available. Gaskets in all cases shall be EPDM suitable for temperatures to 230 degrees F.
C. The following services may use mechanical grooved pipe connections within the building in mechanical spaces and above accessible ceilings. Mechanical chases are not considered accessible.
   1. Heating Hot Water
D. Mechanical grooved pipe connections shall not be used in heating plants or below grade utility distribution systems.
E. Mechanical grooved pipe connections shall not be used in chilled water piping between the cooling coil and the isolation valve for that cooling coil.

F. Fittings and couplings must be suitable for the temperature and pressure involved. In no case is the final system to have a pressure rating of less than 125 psig at the design temperature of the fluid.
G. Acceptable fittings and couplings are listed below, based on Victaulic. When used on galvanized piping, fittings and couplings shall be galvanized. When used on black steel piping, fittings and couplings shall have an enamel coating.
H. Couplings: Ductile iron standard couplings, Style 77; lightweight couplings, Style 75; and rigid couplings. Reducing couplings are not acceptable.
I. Flanges: Ductile iron Style 741 or 742 except at lug type butterfly valves where standard welding flanges shall be used.
J. Fittings: Ductile iron elbows and tees of the manufacturer's standard line may be used in all sizes except bullhead tees will not be accepted. Fabricated steel fittings may be used in all sizes where fitting wall thickness conforms to standard weight pipe. Mechanical-T Style 920 fittings with malleable iron housings may be used for up to 2" outlet size.
K. Mechanical grooved pipe couplings are not allowed as a substitute for expansion compensation.
L. Mechanical grooved flexible couplings are not allowed as a substitute for the flexible connectors.

PART 3 – EXECUTION

3.01 ERECTION

A. Carefully inspect all pipe, fittings, valves, equipment and accessories before installation. Any items that are unsuitable, cracked or otherwise defective shall be rejected and removed from the job site immediately. Excluding minor surface rust, piping that exhibits significant oxidation or corrosion will be rejected.
B. Exercise care at every stage of storage, handling, laying and erecting to prevent entry of foreign matter into piping, fittings, valves, equipment and accessories. Do not erect or install any item that is not clean.
C. Remove all lose dirt, scale, oil, chips, burrs and other foreign material from the internal and external surfaces of all pipe and piping components prior to assembly, including debris associated with cutting, threading and welding.
D. During fabrication and assembly, remove slag and weld spatter from internal pipe surfaces at all joints by peening, chipping and wire brushing.
E. During construction, until system is fully operational, keep all openings in piping and equipment closed except when actual work is being performed on that item of the system. Use plugs, caps, blind flanges or other items designed for this purpose.
F. Furnish and install all flanges, caps, bypasses, drains, valves, etc. required to facilitate flushing and draining all system piping.
G. Install all piping parallel to building walls and ceilings and at heights which do not obstruct any portion of a window, doorway, stairway, or passageway. Where interferences develop in the field, offset or reroute piping as required to clear such interferences. In all cases, consult all project drawings for location of pipe spaces, ceiling heights, door and window openings, or other architectural details before installing piping.
H. Provide anchors, expansion joints, swing joints and/or expansion loops so that piping may expand and contract without damage to itself, equipment, or building.
I. Mitered ells, notched tees, and orange peel reducers are not acceptable. On threaded piping, bushings are not acceptable.
J. "Weldolets" and "Threadolets" may be used for branch takeoffs up to one-half (1/2) the diameter of the main.
K. Install drains throughout the systems to permit complete drainage.
L. Unless written authorization by the A/E, do not route piping through transformer vaults or above transformers, panelboards, motor control centers or switchboards, including the required service space for this equipment, unless the piping is serving this equipment

M. Install all valves, control valves, and piping specialties, including items furnished by others, as specified and/or detailed. Make connections to all equipment installed by others where that equipment requires the piping services indicated in the specifications and drawings.

3.02 WELDED PIPE JOINTS

A. Make all welded joints by fusion welding in accordance with ASME Codes, ANSI B31, and State Codes where applicable.
B. All pipe welding shall be completed by Qualified Welders in accordance with the Contractor's Procedure Specifications.
C. Contractor will ensure that these steps are followed where pipe sections will be joined by welding:
   1. Cleaning – Welding surfaces will be clean and free of defects.
   2. Alignment – Inside diameter of piping components will be aligned as accurately as possible. Internal misalignment shall not exceed 1/16".
   3. Spacing – Pipe sections will be spaced to allow deposition of weld filler material through the entire weld joint thickness.
D. Girth Butt Welds:
   1. Girth butt welds shall be complete penetration welds.
   2. Concavity will not exceed 1/32"
   3. Under cuts will not exceed 1/32"
   4. As welded surfaces are permitted however surfaces will be free from coarse ripples, grooves, abrupt ridges and valleys.
E. Electrodes shall be manufactured in the U.S.A. with coating and diameter as recommended by the manufacturer for the type and thickness of work being done.

3.03 THREADED PIPE JOINTS

A. Use a Teflon based thread lubricant or Teflon tape when making joints; no hard setting pipe thread cement or caulking will be allowed.

3.04 MECHANICAL GROOVED PIPE CONNECTIONS

A. Use pipe factory grooved in accordance with the coupling manufacturer's specifications or field grooved pipe in accordance with the same specifications using specially designed tools available for the application.
B. Lubricate pipe and coupling gasket, align pipe, and secure joint in accordance with the coupling manufacturer's specifications.
C. Support pipe as indicated in the specifications except as modified below. Support each horizontal pipe section at least once between couplings and whenever a change in direction of line flow takes place. Support vertical pipe at every other floor or every other pipe length, whichever is most frequent. Set the base of the riser or the base fitting on a pedestal or foundation.
D. Follow coupling manufacturer's installation recommendations if they are more stringent that the above requirements.

3.05 COPPER PIPE JOINTS

A. Remove all slivers and burrs remaining from the cutting operation by reaming and filing both pipe surfaces. Clean fitting and tube with emery cloth or sandpaper. Remove residue from the cleaning operation, apply flux, and assemble joint. Use 95-5 solder or silver brazing alloy to secure joint as specified for the specific piping service.
B. Where mechanically formed tee fittings are allowed, form mechanically extracted collars in a continuous operation, consisting of drilling a pilot hole and drawing out the tube surface to form a collar having a height of not less than three times the thickness of the tube wall. Use an adjustable collaring device. Notch and dimple the branch tube. Braze the joint, applying heat properly so that pipe and tee do not distort; remove distorted connections.

3.06 WATER SYSTEM

A. Run water mains level or pitch horizontal mains up 1 inch in 40 feet in the direction of flow. Install manual air vents at all high points where air may collect. If vent is not in an accessible location, extend air vent piping to the nearest code acceptable drain location with vent valve located at the drain.
B. Main branches and runouts to terminal equipment may be made at the top, top 45 degree, side, and/or bottom 45 degree of the main provided that there are drain valves suitably located for complete system drainage and manual air vents are located at all top and top 45 degree connections. Bottom connections are not acceptable unless approved by the Owner.
C. Use top or top 45 degree connection to main for upfeed risers and bottom 45 degree connection to main for downfeed risers. Bottom connections are not acceptable unless approved by the Owner.
D. Use a minimum of two elbows in each pipe line to a piece of terminal equipment to provide flexibility for expansion and contraction of the piping systems. Offset pipe connections at equipment to allow for service, such as removal of the terminal device.
E. Use eccentric fittings for changes in horizontal pipe sizes with the fittings installed for proper air venting. Concentric fittings may be used for changes in vertical pipe sizes.

3.07 MAKEUP WATER

A. Install where indicated and/or specified, including all valves, piping specialties and dielectric unions required for a functional system.

3.08 CHEMICAL TREATMENT

A. Install chemical treatment piping as indicated on the drawings, as detailed, and as recommended by the supplier of the chemical treatment equipment.

3.09 VENTS AND RELIEF VALVES

A. Install vent and relief valve discharge lines as indicated on the drawings, as detailed, and as specified for each specific valve or piping specialty item. In no event is a termination to occur less than six feet above a roof line.

3.10 COOLING COIL CONDENSATION DRAINS

A. Trap each cooling coil drain pan connection with a trap seal of sufficient depth to prevent conditioned air from moving through the piping. Extend drain piping to nearest code approved drain location. Construct trap with plugged tee for cleanout purposes as detailed.

3.11 UNIONS AND FLANGES

A. Install a union or flange, as required, at each automatic control valve and at each piping specialty or piece of equipment which may require removal for maintenance, repair, or replacement. Where a valve is located at a piece of equipment, locate the flange or union connection on the equipment side of the valve. Concealed unions or flanges are not acceptable.
B. Dielectric Connections:
   1. Comply with manufacturer's recommendations.
   2. Install in following locations:
      a. Pipe joints connecting dissimilar metals
      b. Pipe joints connecting similar metals where required for cathodically protecting pipe lines from adjoining pipe sections.
   3. Joints and gasketing materials rated to withstand temperature, pressure and other characteristics of services for which used including testing pressure.
   4. Make screwed joints with insulating unions.
   5. Make flanged joints with insulating jackets, bolt sleeves and washers.
   6. Bronze valve between dissimilar metals without the above insulating dielectric connections shall not be considered a dielectric connection.

3.12 GASKETS

A. Store horizontally in cool, dry location and protect from sunlight, water and chemicals. Inspect flange surfaces for warping, radial scoring or heavy tool marks. Inspect fasteners, nuts and washers for burrs or cracks. Replace defective materials.
B. Align flanges parallel and perpendicular with bolt holes centered without using excessive force. Center gasket in opening. Lubricate fastener threads, nuts and washers with lubricant formulated for application.
C. Draw flanges together evenly to avoid pinching gasket. Tighten fasteners in cross pattern sequence (12 – 6 o'clock, 3 – 9 o'clock, etc.), one pass by hand and four passes by torque wrench at 30% full torque, 60% full torque and two passes at full torque per ASME B16.5.

3.13 PIPING SYSTEM LEAK TESTS

A. Verify piping system being tested is fully connected to all components and that all equipment is properly installed, wired, and ready for operation. If required for additional pressure load under test, provide temporary restraints at expansion joints or isolate them during the test. Verify hangers can withstand any additional weight load that may be imposed by the test.
B. Provide all piping, fittings, blind flanges, and equipment to perform the testing.
C. Conduct pressure test with test medium of air or water unless specifically indicated. Minimum test time is indicated in the table below; additional time may be necessary to conduct an examination for leakage. Each test must be witnessed by the Owner's representative. If leaks are found, repair the area with new materials and repeat the test; caulking will not be acceptable.
D. Do not insulate pipe fittings or welds until test has been successfully completed.
E. For hydrostatic tests, use clean water and remove all air from the piping being tested by means of air vents or loosening of flanges/unions. Measure and record test pressure at the high point in the system.
F. For air tests, gradually increase the pressure to not more than one half of the test pressure; then increase the pressure in steps of approximately one-tenth of the test pressure until the required test pressure is reached. Examine all joints and connections with a soap bubble solution or equivalent method. The piping system exclusive of possible localized instances at pump or valve packing shall show no evidence of leaking. After testing is complete, slowly release the pressure in a safe manner.

System	Pressure	Medium	Duration
Heating hot water	100 psig	Water	8 hr.

G. All pressure tests are to be documented on attached form included in this specification.
H. On piping that cannot be tested because of connection to an active line, provide temporary blind flanges and hydrostatically test new section of piping. After completion of test, remove temporary flanges and make final connections to piping. Die penetrate test pass weld or x-ray the piping that was not hydrostatically tested up to the active system.

3.14 HYDRONIC PIPING SYSTEM FLUSHING

A. All new heating hot water system piping shall be flushed thoroughly before the systems are put in to operation. Subsequent to executing the chemical cleaning processes specified in Section 23 25 00 – HVAC WATER TREATMENT, and prior to adding scale and corrosion inhibitors, flush all piping and components with a clean source of water until the discharge from the system is clean. Discharge shall be from drains provided at all low points in the piping, ends of headers and as otherwise necessary to flush and drain the entire system.
B. Project specific procedures shall be established prior to flushing. Before beginning flushing operations, submit proposed flushing procedures to the A/E and Owner's Project Representative for review and approval. Provide sufficient notice to the A/E and/or Owner to allow the flushing operations to be observed.
C. A clean water source shall be tapped into the system downstream of the main circulation pump(s). Provide minimum 2" connection between water source and hot water/chilled water systems including taps with ball valves (or line size tap and ball valve for piping systems smaller than 2"). Provide minimum 2" taps (or line size if mains are smaller than 2") at the ends of headers, the low pint of each of the mains on each floor and as otherwise necessary to flush and

drain the entire system. Provide minimum 2" bypass with shut off valve (or line size if mains are smaller than 2") between the supply and return mains on each floor as where directed by the A/E and Owner's Project Representative or where shown on the drawings. Contractor shall identify proposed clean water source along with the method/location of drain discharge and review with the A/E and Owner's Project Representative prior to installing flushing connections to water source and drain outlets. Provide code required temporary backflow prevention for the clean water source if needed. Provide all temporary taps, valves, piping, bypasses and hoses as needed to accomplish flushing procedures.

D. The Owner's district chilled water system shall NOT be used as a source of water for flushing any piping.

E. Flush piping systems using the following procedure:
   1. Flushing sequence for hot water and chilled water systems is as follows:
   2. Close isolation valves at all coils and wall fin.
   3. Open the temporary bypasses that connect the ends of supply and return mains.
   4. Flush mains by turning on flushing water source and sequentially opening drains on mains on each floor until the discharge is clean. This will flush the mains without forcing water/debris into the branches and run out pipes.
   5. Close isolation valves located downstream of coils/wall fin.
   6. Open isolation valves located upstream of coils/wall fin.
   7. Open individual drain valves upstream of coils/wall fin until the discharge is clean. This will flush the supply branch and run out lines between the mains and the coils/wall fin without running water/debris through the TCV or coils/wall fin.
   8. Close the individual drain valves upstream of coils/wall fin.
   9. Open drain valves at low points in the return piping mains.
   10. Open the individual isolation valves located downstream of the coils/wall fin. This will flush the return branch and run out lines located between the coils/wall fin and the mains back into the mains and out the drains on the return mains. The water going through the coil/wall fin should be already be clean since this section was flushed previously.
   11. Repeat steps 1-3 to clean debris from the mains.

F. Isolate all coils while flushing risers and mains. Flush the mains on each floor individually, starting at the top of the building and working down towards the basement level. After risers and mains have been flushed clean, individually open the drain valves in each branch circuit to discharge any debris that may have accumulated in the branch piping.

G. As directed by Owner, the Contractor will be required to open drain valves at selected locations in the system to verify the effectiveness of flushing procedures. If sediment or debris is identified in the system, it will be flushed again and reinspected at no expense to the Owner.

H. After flushing operations are complete, drain and/or blow out any residual water, clean and replace all strainers, and add scale and corrosion inhibitors as specified in Section 23 25 00. Leave flushing connections/valves in place and cap.

I. All flushing procedures shall be documented by completing and submitting the report form included at the end of this Section.

J. Initial Fill And Vent:
   1. Fill hydronic systems with appropriate working fluids as specified. All system fluids shall be chemically treated as specified in Section 23 25 00 – HVAC WATER TREATMENT.
   2. For closed piping systems, all air trapped at high points shall be relieved through the manual air vents prior to notifying Owner that the systems are ready to be tested and balanced.

END OF SECTION

PIPING SYSTEM LEAKAGE TEST REPORT

Date Submitted: _____

Project Name:_____

Location:_____ **Project No:**_____

Contractor:_____

☐ **HVAC** ☐ **Refrigeration** ☐ **Controls**

☐ **Power Plant** ☐ **Plumbing** ☐ **Sprinkler**

Test Medium: ☐ **Air** ☐ **Water** ☐ **Other**_____

Test performed per specification section No._____

Specified Test Duration _____ **Hours** **Specified Test Pressure** _____**PSIG**

System Identification:_____

Describe Location:_____

_____

Test Date:_____

Start Test Time:_____ **Initial Pressure:**_____**PSIG**

Stop Test Time:_____ **Final Pressure:**_____**PSIG**

Tested By:_____ **Witnessed By:**_____

Title:_____ **Title:**_____

Signed:_____ **Signed:**_____

Date:_____ **Date:**_____

Comments:_____

_____

_____

_____

_____

_____

_____

PIPING SYSTEM FLUSHING REPORT

Date Submitted: _____

Project Name:_____

Location:_____ **Project No:**_____

Contractor:_____

System Identification (check one):

☐ **Chilled Water** ☐ **Process Chilled Water** ☐ **Heat Reclaim**

☐ **Heating Hot Water** ☐ **Other** _____

Describe procedure: _____

_____

_____

_____

_____

Flush Date: _____ **Start Time:** _____ **Stop Time:** _____

Pressure of Water Source:_____ **PSIG** **Describe water source and method of connection to source:**

_____

_____

_____

Flushed By: _____ **Witnessed By:** _____

Title: _____ **Title:** _____

Company: _____ **Agency:** _____

Signed: _____ **Signed:** _____

Date: _____ **Date:** _____

Describe results: _____

_____

_____

_____

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SECTION 23 21 15
IN-FLOOR HEATING SYSTEM

PART 1 – **GENERAL**
- A. Related Work
- B. Reference
- C. Quality Assurance
- D. Engineered Shop Drawings
- E. Design Criteria

PART 2 **PRODUCTS**
- A. Manufacturers
- B. Piping
- C. Manifolds
- D. Controls
- E. Control Valves and Operators

PART 3 **EXECUTION**
- A. Installation
- B. Training

1.01 SCOPE

A. This section includes specifications for the in-floor heating system, including piping, fittings, specialties and controls for the complete system.

1.02 RELATED WORK

A. Section 23 05 23 - General-Duty Valves for HVAC Piping
B. Section 23 05 15 - Piping Specialties
C. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment
D. Section 23 09 14 - Electric Instrumentation and Control Devices for HVAC
E. Section 23 09 23 - Direct Digital Control System for HVAC
F. Section 23 09 93 – Sequence of Operations for HVAC
G. Section 23 07 00 - HVAC Insulation
H. Section 23 25 00 - HVAC Water Treatment.

1.03 REFERENCE

Applicable provisions of Division 1 govern work under this section.

1.04 QUALITY ASSURANCE

Substitution of Materials: Refer to Division 1 and the General Conditions of the Contract.

1.05 ENGINEERED SHOP DRAWINGS

A. The in-floor system provider shall provide a fully engineered, detailed design and layout of the in-floor heating system. The engineered shop drawings shall be submitted and shall include the following items at a minimum.
   1. Piping materials
   2. Detailed in slab piping layouts
   3. Piping specialties, manifolds and manifold cabinets
   4. Control components and schematic control diagrams
   5. Detailed installation instructions
   6. Submit CAD drawings of layouts, tubing dimensions, and tubing spacing configurations.

B. The in-floor system provider shall calculate and verify the required GPM and pressure drop for each piping loop and the total piping system and compare this to the pump capacities listed on the plans. If the actual engineered installation requires a change in pump requirements, the supplier shall notify the contractor and the engineer, in writing of the new requirements. Should the supplier fail to identify changes in pump requirements prior to the system being installed, the supplier will be responsible for

all costs associated with the replacement of system pumps to obtain the required performance of the in-floor piping system.

C. The in-floor system provider shall provide locations for the in slab temperature floor sensors in concrete slab. Provide details for mounting sensor in slab. The shop drawings shall be specifically prepared for this project.

D. The control system shop drawings submitted shall include electrical interconnecting schematic diagrams.

1.06 DESIGN CRITERIA

A. System electrical components shall be U.L. listed and shall bear the U.L. label.

B. Installer: A firm specializing and experienced in radiant heating system installation for no less than 5 years. All engineering and commissioning work shall be done by qualified personnel in the direct employ of this manufacturer, or of an Authorized Representative of that manufacturer that provides engineering and commissioning of the manufacturers radiant piping system. Where installing contractor is an authorized representative of the in-floor radiant manufacturer, submit written confirmation of such authorization. Indicate in letter of authorization that the installing contractor has successfully completed all necessary training required for the engineering, installation, and commissioning of the in-floor radiant systems to be provided for the project, and that such authorization has been in effect for a period of not less than five years. The letter of authorization should also indicate that the installing contractor is authorized to install the manufacturer's in-floor radiant at the project location at the time the project is bid. Installation of the equipment shall be done by qualified mechanics in the direct employ or be directly subcontracted and under the supervision of the manufacturer or Authorized Representative. Controls and control components shall be provided by the same manufacturer providing the in-floor heating piping system or shall be a manufacturer of in-floor heating system controls as determined by the piping system manufacturer. The in-floor heating system piping and controls shall have single source responsibility.

C. Controls and control components shall be provided by the same manufacturer providing the in-floor heating piping system or shall be a manufacturer of in-floor heating system controls as determined by the piping system manufacturer. The in-floor heating system piping and controls shall have single source responsibility.

D. Transformers, relays, operators, thermostats and valves not specifically mentioned within the specifications but necessary to make the in-floor heating control system complete and operative within the functional intent of this specification shall be furnished and installed by the HVAC contractor. For the control sequence of operation, provide the necessary control components and wiring, to provide a fully functional system.

E. Setpoints shall be adjustable and the controls shall allow manual override to select off, operating or idling modes.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. PIPING AND ACCESSORIES

B. WattRadiant, Uponor-Wirsbo, Rehau or Heatlink.

2.02 PIPING

A. PIPE

1. Cross-linked polyethylene, 1/2" or 5/8" nominal I.D. tubing rated for a maximum working temperature of 180°F and a maximum working pressure of 100 PSI, ASTM Spec. F-876. Piping section within the slab shall be continuous without joints or fittings.

B. FITTINGS

1. Constructed of dezincification brass consisting of a barbed insert, compression ring and a compression nut.

C. SPECIALTIES

1. Provide all piping specialties and supports for a complete installation.

2.03 PRE-ASSEMBLED MANIFOLDS

A. Cast brass construction, dezincification resistant in sizes and arrangements as specified on the plans with integral, manual shut-off valves on return headers and integral manual balancing valves on supply headers.

B. Manifold shall also include pre-wired pump (where shown/scheduled), temperature gauge, vent-purge assembly and non-electric 3-way mixing valve configuration with connects to piping manifold. Pre-assembled manifold shall be mounted in metal wall mounted cabinet, approximately 40”x29”x6-1/2” per radiant zone.

2.04 FITTINGS AND SPECIALTIES

1. End caps with integral gasket, fill/drain valve and manual air vent, bushings, and manifold support brackets.

2.05 CONTROLS

A. CONTROLLER

1. Microprocessor based, hydronic In-floor radiant heating system controller capable of full control of system pumps, slab temperature, space temperature through control and measurement of the slab temperature and space temperature.
2. Furnish a battery digital thermostat, equal to DualTemp – nonprogrammable for heat-only thermostat to both sense air and floor conditions. Floor sensor will restrict the maximum floor temperature. Digital thermostat to have manual temperature setback feature with a 4 F setback. Provide 24 VAC transformer to power relay coils.
3. The controller shall allow manual adjustment of the following; panel system supply/return water temperature differential (set at 20° F nominal), maximum panel supply water temperature (set at 140°F nominal), valve operator speed, slab operating mode temperature and slab idle mode temperature.
4. Mount controller and devices in wall mounted cabinet noted above.
5. Tekmar or approved equal.
6. Control setpoints shall be adjustable.
7. Coordinate with other equipment controls and electrical contractor for coordination and power.

B. FLOW SWITCH

1. Provide flow switch in manifold assembly. Target Type (Paddle) Flow Switches:
2. Adjustable set point, paddle type. Select switches for accuracy and ranges to match process conditions, electrical requirements, and to implement intended functions.
3. Furnish water-sensing switches with NPT fittings suitable for piping mounting. Switches shall be rated for 150 psi.
   a. Maximum Temperature: 200°F
   b. Repeatability: ±1%
   c. Pressure Rating: 150 psi
4. Flow switch shall be wired into controls for each manifold system as indicated on the drawings.

2.06 CONTROL VALVES AND OPERATORS

A. Provide automatic control valve(s) and valve operators for a fully functional system.

B. Valves shall be rated for the fluid being controlled and shall be constructed for the pressure and temperature ratings of the piping system served.

C. Valve bodies 2½" size and larger shall have flanged connections. Smaller valve bodies may be either screwed or flanged. Screwed connections shall have union fittings.

D. The valve operator(s) shall have electric type, oil submerged, motorized, positive positioning electric type operators with external position indicators.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Horizontal piping shall be run level without pockets.

B. Provide manual air vents and vent all high points and vent at the manifold locations.

C. Mount valves and operators in location and position for ease of service.

D. The in-floor heating system piping shall be pressure tested (before slab construction) with compressed air at a pressure of 60 PSIG for a period of not less than 24 hours. Isolate and protect equipment not designed to withstand the test pressure. During slab pour, a pressure of 60 PSIG shall be maintained on the in-floor tubing

system. The 60 PSIG pressure shall be maintained for a period of not less than 24 hours thereafter to verify system integrity. Notify the Engineer at least 72 hours before pipe testing so that they can be present during the pipe testing process.

E. The entire in-floor piping and control system shall be installed in strict accordance with the manufacturer's published instructions and recommendations.

F. The Contractor shall obtain from the manufacturer of the in-floor heating system, certified installation supervision and startup indicating that the entire system has been installed and placed into operation in accordance with the manufacturer's instructions and recommendations. The Contractor shall obtain a certified report prepared and signed by the manufacturer's representative in responsible charge. The startup reports shall be submitted to the Engineer along with or prior to the Contractor's certification of completion.

G. The Contractor shall set and calibrate automatic control system devices to achieve the required sequence of operation. Temperature sensors provided shall be tested for accuracy at its specific sensing location and replaced where error exceed plus or minus two degrees.

H. Coordinate with Temperature Control Contractor on wiring and monitoring points into Building Automation System. Refer to Sections 23 09 23, 23 09 14, and 23 09 93.

3.02 TRAINING

A. All training provided for Owner shall comply with the format, general content requirements and submission guidelines.

END OF SECTION

SECTION 23 21 23
HYDRONIC PUMPS

PART 1 – GENERAL

1.01 SCOPE OF WORK
A. Contractor shall provide all labor and materials for a complete system in this specification section.

1.02 SECTION INCLUDES
A. This section includes specifications for water pumps used for HVAC applications. Included are the following topics:
   1. In-Line Centrifugal Pumps

1.03 RELATED WORK
A. Applicable provisions of Division 1 shall govern work under this section.
B. Section 23 05 00 – Common Work Results for HVAC
C. Section 23 05 13 – Common Motor Requirements for HVAC Equipment
D. Section 23 09 93 – Sequence of Operations for HVAC Controls

1.04 SUBMITTALS
A. Refer to Section 23 05 00 – Common Work Results for HVAC, Submittals. In addition to general content specified under Section 23 05 00 – Common Work Results for HVAC, supply the following submittals:
   1. In-Line Centrifugal Pumps
B. Include data concerning dimensions, capacities, materials of construction, ratings, weights, pump curves with net positive suction head requirements, manufacturer's installation requirements, manufacturer's performance limitations, and appropriate identification.
C. Include motor replacement availability and lead times to project location.
D. Pump curves shall identify design point of operation.

1.05 QUALITY ASSURANCE
A. Refer to Division 1 for equals and substitutions.

1.06 DESIGN CRITERIA
A. Pump sizes, capacities, pressures and operating characteristics shall be as scheduled.
B. Pumps shall meet or exceed operating efficiencies scheduled.
C. Provide all pumps with motors, impellers, drive assemblies, bearings, coupling guard, and other accessories specified. Statically and dynamically balance all rotating parts. Provide flanged connections on all pumps unless specified otherwise. Service or repair of base mounted pumps shall not require breaking piping connections or removal of motor.
D. Where a pump is specified for parallel operation, the scheduled conditions are for that pump with both pumps operating; i.e., total system flow rate is twice that scheduled for a single pump. When only one of the parallel pumps is operating, the operating point of that pump must fall within the manufacturer's recommended operating range.
E. Provide pump with a motor sized for non-overloading over the entire pump curve. Motors to be 1750 rpm unless specified otherwise. Motors shall be standard, off the shelf, readily available for replacement. Special or customize motors will not be acceptable unless pre-bid approved.
F. Furnish each pump and motor with a nameplate giving the manufacturer's name, serial number of pump, capacity in GPM and head in feet at design condition, horsepower, voltage, frequency, speed and full load current.
G. Test all pumps, clean and paint before shipment. The manufacturer shall certify all pump ratings.
H. All pumps to operate without excessive noise or vibration.

I. After completion of balancing, provide replacement of impellers, or trim impellers to provide specified flow at actual pumping head, as installed.
J. Furnish one spare seal and casing gasket for each pump to owner.

1.07 **OPERATION AND MAINTENANCE DATA**
A. All operations and maintenance data shall comply with the submission and content requirements specified in Section 23 05 00 – Common Work Results for HVAC.

PART 2 **– PRODUCTS**

2.01 **GENERAL**
A. Refer to 23 05 13 – Common Motor Requirements for HVAC Equipment for ground ring requirements.

2.02 **IN-LINE CENTRIFUGAL PUMPS**
A. Manufacturers: Bell and Gossett, Armstrong, Thrush, Taco, Grundfos, Aurora.
B. Type: Single stage, direct connected, resiliently mounted motor for in-line mounting, oil lubricated, 175 psig maximum working pressure at operating temperature of 225°F continuous, 250°F intermittent.
C. Casing: Cast iron or stainless steel; flanged suction and discharge connection; with plugged taps for vent, drain, suction and discharge gauges.
D. Impeller: Brass or bronze, keyed to the shaft, single suction enclosed type, hydraulically and dynamically balanced.
E. Bearings: Two, oil lubricated bronze sleeves or ball bearings capable of being greased.
F. Shaft: Stainless steel or carbon steel with stainless steel or bronze sleeve, integral thrust collar.
G. Seal: Mechanical type, carbon rotating against a stationary ceramic seat, 225°F maximum continuous operating temperature.
H. Drive: Close coupled.

PART 3 **– EXECUTION**

3.01 **INSTALLATION**
A. Install all pumps in strict accordance with manufacturer's instructions. Access/service space around pumps shall not be less than minimum space recommended by pump manufacturer.
B. Support piping adjacent to pump such that no weight is carried on pump casings.
C. Decrease from line size at pump connections with suction diffusers where specified, long radius reducing elbows or concentric reducers/increasers in the vertical piping, and eccentric reducers/increasers for horizontal piping. Install eccentric reducers/increasers with the top of the pipe level.
D. All valves and piping specialties must be full line size as indicated on the drawings.
E. Lubricate pumps before startup. After completion of the system and before startup of the pump, the pump shall be lubricated in strict accordance with the manufacturer's instructions. A metal instruction plate shall be attached to the pump in a location where it is clearly visible. These instructions shall indicate the recommended lubricant, the points of lubrication, and the recommended frequency of lubrication. The base mounted pump shall be installed dead level and shall be grouted in accordance with manufacturer's recommendations. The electrical connection to the pump shall be made through the use of flexible conduit, sealtight or liquidtight, at least 18 inches long. The pump shall be so installed that the pump can be completely removed without the dismantling or removal of any piping or valves. The adjacent piping shall be carefully fitted and erected so that the pump can be installed or removed from the pipe line without forcing or springing.
F. Inspect, test, and start base mounted pump and have it aligned with a dial indicator to 0.002". Discharge and suction readings shall be documented in the Operations and Maintenance Manual and elsewhere where appropriate.

G. After the system has been completed and the pump started, both shall be inspected for vibration and excessive noise and all such noise or vibration shall be immediately corrected.
H. Install a full line size spring loaded check valve and balancing valve in the pump discharge piping.
I. At contractor's option, combination shut-off, check, balancing valve may be substituted instead of separate valves. Reference Section 23 05 23 – General Duty Valves for HVAC Piping.

3.02 **TRAINING**

A. See Section 23 05 00 – Common Work Results for HVAC for general training requirements.

END OF SECTION

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SECTION 23 25 00
HVAC WATER TREATMENT

PART 1 – GENERAL

1.01 SCOPE OF WORK
A. Contractor shall provide all labor and materials for a complete system in this specification section.

1.02 SECTION INCLUDES
A. This section includes specifications for chemical treatment of all water, steam, and condensate systems. Included are the following topics:
   1. System Cleaner
   2. System Inhibitor
   3. Closed Water System Treatment
   4. Treatment Equipment

1.03 RELATED WORK
A. Applicable provisions of Division 1 shall govern work under this Section.
B. Section 23 05 00 – Common Work Results for HVAC
C. Section 23 05 15 – Piping Specialties
D. Division 26 Electrical Specifications

1.04 SUBMITTALS
A. Refer to Section 23 05 00 – Common Work Results for HVAC, Submittals. In addition to the general content specified under Section 23 05 00 – Common Work Results for HVAC, supply the following submittals:
   1. System Cleaner
   2. System Inhibitor
   3. Closed Water System Treatment
   4. Treatment Equipment
B. Provide data concerning dimensions, capacities, materials of construction, weights, operating sequence, composite wiring diagrams and appropriate identification. Chemical data to include the description of the chemical, its composition, its function, and the associated material safety data sheet.

1.05 QUALITY ASSURANCE
A. Refer to Division 1 for equals and substitutions.

1.06 DESIGN CRITERIA
A. Recommend a periodic test procedure and chemical treatment program for each system.
B. Treat the following systems:
   1. Heating Hot water
C. Provide the initial chemical treatment for all systems based on a complete system fluid analysis prior to the equipment installation. The initial chemical treatment supply of chemicals for each system shall be adequate for the start-up and testing period, for the time the systems are being operated by the Contractor for temporary heating and cooling, and for one year after start-up of the system.
D. The chemicals used in the condenser water treatment system shall use only liquid chemicals and shall contain no phosphates or chromates.
E. Provide electrical devices, motors, wiring and conduit in accordance with the applicable sections of Division 26 Electrical Specifications.

1.07 OPERATION AND MAINTENANCE DATA
A. Provide for the services of the manufacturer's trained representative to approve the installation and instruct the owner in the operation of each system.

B. Include data on chemical feed pumps, agitators, and other equipment including spare parts lists, procedures, and treatment programs. Include step by step instructions on test procedures including target concentrations.

1.08 MAINTENANCE SERVICE

A. Furnish service and maintenance of treatment systems for one year from date of substantial completion.
B. Provide add alternate for two additional year option.
C. Provide monthly technical service visits to perform field inspections and make water analysis on site. Detail findings in writing on proper practices, chemical treating requirements, and corrective actions needed. Submit two copies of field service report after each visit to the owner.
D. Provide laboratory and technical assistance services for the warranty period.
E. Provide site inspection of equipment during scheduled shutdown to evaluate success of the treatment program. Make recommendations in writing based on these inspections.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Bulter Chemical, Betz Entac, Fremont Industries, Garrat-Callahan, Mitco Water Labs, Nalco Chemical Co., Western Water Management, HOH, Great Lakes Treatment.

2.02 SYSTEM CLEANER

A. Blend of organic alkaline penetrants, emulsifiers, surfactants and corrosion inhibitors that remove grease and petroleum products from the interior of piping systems. Cleaners that contain trisodium phosphate are specifically not acceptable.

2.03 SYSTEM INHIBITOR

A. Scale and corrosion inhibitor consisting of boron nitrite, benzol thiazol, benzotriazole, mercapto-benzo-thiazole and tolyltrizole silicates.

2.04 CLOSED WATER SYSTEM TREATMENT

A. Sequestering agent to reduce deposits and adjust pH: polyphosphate.
B. Corrosion inhibitors: boron-nitrite, sodium nitrite and borax, sodium totyltriazole, low molecular weight polymers, phosphonates, sodium molybdate, or sulphites.
C. Conductivity enhancers: phosphates or phosphonates.

2.05 TREATMENT EQUIPMENT

A. Bypass Feeder: 5 gallon minimum capacity, constructed of cast-iron or steel, 125 psig working pressure, either a screw type cover or a valved funnel opening to feed chemical into the Hydronic system, prime coat of paint. Provide drain valve in bottom and recirculating valves on the side. Provide integral stainless steel strainer basket and 5 micron filter bags. Acceptable manufacturers: HOH Chemicals, York-Shipley and Neptune.
B. Water Meter: Displacement type cold water meter with sealed, tamper-proof magnetic drive, bronze housing, 125 psig minimum working pressure, impulse contact register when required by the sequence, single pole double throw dry contact switch. Meters must be capable of being used with remote readout heads and capable of being sealed to prevent tampering.

PART 3 – EXECUTION

3.01 PREPARATION

A. Prior to cleaning, verify that systems are operational, filled, started, and vented. Use water meter to record capacity in each system.
B. Place terminal control valves in the full-open position

3.02 CLEANING SEQUENCE

A. General:
   1. Systems are to be cleaned before they are used for any purpose except conduct pressure test before cleaning. Add cleaner to closed systems at concentrations as recommended by the manufacturer. Remove water filter elements from the system before starting circulation. For steam systems, fill boilers only, using the water and cleaner solution.
   2. Use neutralizer agents on recommendation of the system cleaner supplier and approval of the Architect/Engineer.
   3. Flush open systems with clean water for one hour minimum. Drain completely and refill.
   4. Remove, clean, and replace strainer screens.
   5. Inspect, remove sludge, and flush low points with clean water after cleaning process is completed. Include disassembly of components as required.
   6. Use attached form to document system cleaning, flushing, and proper startup.

B. Hot Water Heating Systems: Add cleaner to the system water until the M alkalinity value is 250 above that of the initial fill water. Verify the M alkalinity level before and after the addition of the cleaner by means of chemical tests that are observed by the Owner's construction representative; include results of all tests in the Operating and Maintenance manuals. Apply heat while circulating, slowly raising temperature to 160°F and maintain for 12 hours minimum; vent all high points to assure 100% system circulation. Remove heat and circulate to 100°F or less; drain system as quickly as possible and refill with clean water. Circulate for 6 hours at design temperature, vent air at all high points, then drain. Refill with clean water and repeat until the system cleaner is removed and the M alkalinity level returns to normal. Remove and clean all strainers. Re-vent the system and install clean filter elements in water filters. Treat with scale and corrosion inhibitors before using the system for building heating or cooling.

3.03 CLOSED WATER SYSTEMS

A. Install a separate bypass type feeder at the pumps for each closed hot water heating system. Install in upright position with top of funnel not more than 48” above floor. Provide a separate set of supply and return lines from each pump in the system and install ball valves in each of these lines. Locate the system connection that supplies the feeder upstream of the discharge shutoff valve for the pump. Locate the system connection that returns treatment back to the system at a convenient point downstream of the pump discharge shutoff valve. Pipe drain to nearest floor drain.

B. Install a water meter upstream of the pressure reducing valve in the makeup line to each closed system. Locate the meter on the domestic water side of the pressure reducing valve and in such a manner that the meter can be easily read.

3.04 TRAINING

A. See Section 23 05 00 for general training requirements.

B. In addition to the training provided in Section 23 05 00 – Common Work Results for HVAC, provide an additional 4 hours of training for water treatment system provided on the project.

END OF SECTION

PIPE CLEANING AND TREATMENT REPORT

Project Number: _____

Date Submitted: _____

Project Name: _____
Location: _____
Contractor: _____

System Tested: **Hot Water**_____ **Glycol Water**_____ **Chilled Water**_____

Fuel Oil_____ **Condenser Water**_____ **Steam**_____ **Condensate**_____

System Volume:_____

Materials Used (Provide MSDS for each)

Cleaner:_____ **Quantity Used:**_____
Inhibitor:_____ **Quantity Used:**_____
Sequestering Agent:_____ **Quantity Used:**_____
Algaecide:_____ **Quantity Used:**_____
Neutralizer:_____ **Quantity Used:**_____
Glycol:_____ **Quantity Used:**_____
Glycol Solution Water Source:_____ **Percent glycol by volume:**_____

M Alkalinity

Prior to Cleaning:_____ **During Cleaning:**_____ **After Flushing:**_____

System Temperature

Prior to Cleaning:_____ **During Cleaning:**_____

Duration	Date/Time Start	Date/Time Stop
Initial Circulation	_____	_____
Draindown	_____	_____
System Refill	_____	_____
Final Circulation	_____	_____
Heating system Warmup	_____	_____

Component Checklist (Describe procedures performed at each)

Strainers:_____
Filters:_____
Vents:_____
Drains:_____
Traps:_____
Branch Lines:_____
Terminal Units:_____
Boilers:_____
Chillers:_____

Comments:_____
_____
_____
_____
_____
_____
_____
_____

SECTION 23 31 00
HVAC DUCTS AND CASINGS

PART 1 – GENERAL

1.01 SCOPE OF WORK
A. Contractor shall provide all labor and materials for a complete system in this specification section.

1.02 SECTION INCLUDES
A. This section includes specifications for all duct systems used on this project. Included are the following topics:
   1. High Pressure Ductwork (Pressure class 3 inch and over)
   2. Low Pressure Ductwork (Maximum 2 inch pressure class)
   3. Duct Sealant
   4. Gaskets

1.03 RELATED WORK
A. Applicable provisions of Division 1 govern work under this Section.
B. Section 23 05 00 – Common Work Results for HVAC
C. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC
D. Section 23 05 94 – HVAC Air Duct Cleaning
E. Section 23 33 00 – Air Duct Accessories

1.04 SUBMITTALS
A. Refer to Section 23 05 00 – Common Work Results for HVAC, Submittals. In addition to the general content specified under Section 20 05 00 – Common Work Results for HVAC, supply the following submittals:
   1. High Pressure Ductwork (Pressure class 3 inch and over)
   2. Low Pressure Ductwork (Maximum 2 inch pressure class)
   3. Duct Sealant
   4. Gaskets
B. Include manufacturer's data and/or Contractor data for the following:
   1. Fabrication and installation drawings.
   2. Schedule of duct systems including material of construction, gauge, pressure class, system class, method of reinforcement, joint construction, fitting construction, and support methods, all with details as appropriate.
   3. Duct sealant and gasket material.

1.05 REFERENCE STANDARDS
A. ANSI SS-EN 485-2 Aluminum and Aluminum Alloys-Sheet, Strip and Plate-Part 2: Mechanical Properties
B. ASTM B209 Specification for Aluminum and Aluminum-Alloy Sheet and Plate
C. ASTM A90 Test Method for Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles
D. ASTM A167 Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
E. ASTM A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
F. ASTM 924 Standard Specification for General Requirements for Sheet Steel, Metallic-coated by the Hot-dip Method
G. ASTM E 84 Test Method for Surface Burning Characteristics of Building Materials
H. ASTM C 1338 Test Method for Determining Fungal Resistance of Insulation Materials and Facings
I. ASTM G 21 Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi

J. ASTM C 916 Standard Specification for Adhesives for Duct Thermal Insulation NFPA 90A Standard for the Installation of Air Conditioning and Ventilating Systems
K. UL 181 Standard for Safety for Factory Made Air Ducts and Air Connectors.

1.06 **QUALITY ASSURANCE**
A. Refer to division 1 for equals and substitutions.

1.07 **DESIGN CRITERIA**
A. Construct all ductwork to be free from vibration, chatter, objectionable pulsations and leakage under specified operating conditions.
B. Use material, weight, thickness, gauge, construction and installation methods as outlined in the following SMACNA publications, unless noted otherwise:
1. HVAC Duct Construction Standards, Metal and Flexible, 3rd Edition, 2005
2. HVAC Systems - Duct Design, 4th Edition, 2006
3. HVAC Air Duct Leakage Test Manual, 2nd Edition, 2012
4. Rectangular Industrial Duct Construction Standard, 2nd Edition, 2004
5. Round Industrial Duct Construction Standards, 2nd Edition, 1999
C. Use products which conform to NFPA 90A, possessing a flame spread rating of not over 25 and a smoke developed rating no higher than 50.

1.08 **DELIVERY, STORAGE AND HANDLING**
A. Promptly inspect shipments to ensure that Ductwork is undamaged and complies with the specification.
B. Protect Ductwork against damage.
C. Protect Ductwork by storing inside or by durable, waterproof, above ground packaging. Do not store material on grade. Protect Ductwork from dirt, dust, construction debris and foreign material. Where end caps/packaging are provided, take precautions so caps/packaging remain in place and free from damage.
D. Offsite storage agreements do not relieve the contractor from using proper storage techniques.
E. Storage and protection methods must allow inspection to verify products.

PART 2 – **PRODUCTS**

2.01 **GENERAL**
A. All sheet metal used for construction of duct shall be 24 gauge or heavier except for round and spiral ductwork and spiral duct take-offs 12" and below may be 26 gauge where allowed in SMACNA HVAC Duct Construction Standards, Metal and Flexible, 3rd Edition, 2005.
B. Duct sizes indicated on plans are net inside dimensions; where duct liner is specified, dimensions are net, inside of liner.

2.02 **DUCTWORK PRESSURE CLASS**
A. Minimum acceptable SMACNA duct pressure class, for all ductwork except transfer ductwork, is 2 inch W.G. positive or negative, depending on the application. Transfer ductwork minimum acceptable duct pressure class is 1 inch W.G. positive or negative, depending on the application. Duct system pressure classes not indicated on the drawings to be as follows:

Supply duct upstream of VAV boxes	3 in. pressure class
Supply duct downstream of VAV terminals	2 in. pressure class
Transfer ducts	1 in. pressure class
Low pressure exhaust ducts	3 in. negative pressure class
Return ducts	3 in. negative pressure class

2.03 **MATERIALS**
A. Galvanized Steel Sheet: Use ASTM A 653 galvanized steel sheet of lock forming quality. Galvanized coating to be 1.25 ounces per square foot, both sides of sheet, G90 in accordance with ASTM A90. Provide "Paint Grip" finish or galvanneal sheetmetal for ductwork that will be painted.

B. Uncoated Black Steel Sheet: First quality, soft steel sheet capable of welding or double seaming without fracture.
C. Aluminum Sheet: Use ANSI/ASTM B209 aluminum sheet, alloy 3003H-14, capable of double seaming without fracture.

2.04 HIGH PRESSURE DUCTWORK (PRESSURE CLASS 3 INCH AND OVER)

A. Manufacturers: Ajax, Semco, United Sheet Metal, Sheet Metal Connectors.
B. Machine formed round and/or flat oval spiral lock seam duct constructed of galvanized steel.
C. Rectangular high pressure duct using a transverse joint system as manufactured by Ductmate, Nexus, TDC or TDF, may be used at contractor's option. Duct to be flanged, gasketed and sealed.
D. Contractor fabricated ductwork meeting specified construction standards is acceptable with prior approval of Architect/Engineer. Submit construction details, a description of materials to be used, type of service, reinforcing methods, and sealing procedures.
E. Use a perforated inner liner on double wall high-pressure duct. Annular space between inner liner and outer duct to be filled with 1 inch glass fiber insulation.
F. Use cemented slip joints with 2 inch minimum overlap, flanged connections, or welded/brazed connections, unless noted otherwise for special applications. Prime coat welded joints.
G. Provide standard 90 degree conical tee takeoffs except for exhaust at velocities over 2000 feet per minute, use 45° lateral connections; straight taps or bullhead tees are not acceptable.
H. Internal bracing will not be accepted on ductwork below 48 inches.
I. Use turning vanes as specified in Section 23 33 00 – Air Duct Accessories.
J. Provide bellmouth fittings or expanded fittings at each duct connection to air plenums.
K. Provide pressure relief fittings as indicated on the plans and/or details.
L. Transform duct sizes gradually, not exceeding 15 degrees divergence and 30 degrees convergence.

2.05 LOW PRESSURE DUCTWORK (MAXIMUM 2 INCH PRESSURE CLASS)

A. Fabricate and install ductwork in sizes indicated on the drawings and in accordance with SMACNA recommendations, except as modified below.
B. Construct so that all interior surfaces are smooth. Use slip and drive or flanged and bolted construction when fabricating rectangular ductwork. Use spiral lock seam construction when fabricating round spiral ductwork. Sheet metal screws may be used on duct hangers, transverse joints and other SMACNA approved locations if the screw does not extend more than 1/2 inch into the duct.
C. Use elbows and tees with a center line radius to width or diameter ratio of 1.5 wherever space permits. When a shorter radius must be used due to limited space, install single wall sheet metal splitter vanes in accordance with SMACNA publications, Type RE 3. Where space will not allow and the C value of the radius elbow, as given in SMACNA publications, exceeds 0.31, use rectangular elbows with turning vanes as specified in Section 23 33 00 – Air Duct Accessories. Square throat-radius heel elbows will not be acceptable. Straight taps or bullhead tees are not acceptable.
D. Where rectangular elbows are used, provide turning vanes in accordance with Section 23 33 00 – Air Duct Accessories.
E. Provide expanded take-offs or 45 degree entry fittings for branch duct connections with branch ductwork airflow velocities greater than 700 fpm. Square edge 90-degree take-off fittings or straight taps will not be accepted.
F. Button punch snaplock construction will not be accepted on aluminum ductwork.
G. No variation of duct configuration or sizes permitted except by written permission of the Architect/Engineer. Substitution of round ducts for rectangular ducts will only be considered if sized in accordance with ASHRAE table of equivalent rectangular and round ducts.
H. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible. Divergence upstream of equipment shall not exceed 30 degrees; convergence downstream shall not exceed 45 degrees.
I. Transverse joints for rectangular ducts shall be in accordance with SMACNA HVAC Duct Construction Standards type T-15 through T-24.
J. Button punch snap lock (SMACNA L-2) and grooved seams (SMACNA L-3) shall not be used on rectangular duct longitudinal seams.
K. Longitudinal seams for round ducts shall be lock type spiral seam (SMACNA RL-1) or grooved seam (SMACNA RL-5).

L. Snaplock seams are acceptable on low pressure round ducts with a diameter of 12" or less.

2.06 **DUCT SEALANT**

A. Manufacturer: 3M 800, 3M 900, H.B. Fuller/Foster, Hardcast, Hardcast Peal & Seal, Lockformer cold sealant, Mon-Eco Industries, United Sheet Metal. Silicone sealants are not allowed in any type of ductwork installation.
B. Install sealants in strict accordance with manufacturer's recommendations, paying special attention to temperature limitations. Allow sealant to fully cure before pressure testing of ductwork, or before startup of air handling systems.
C. For plenums installations, use duct sealant with a flame spread index of not more than 25 and smoke-developed index of not more than 50. When tested in accordance with ASTME84 or UL 723.

2.07 **GASKETS**

A. 2 Inch Pressure Class and Lower: Soft neoprene or butyl gaskets in combination with duct sealant for flanged joints.
B. 3 Inch Pressure Class and Higher: Butyl gaskets.

PART 3 **– EXECUTION**

3.01 **INSTALLATION**

A. Verify dimensions at the site, making field measurements and drawings necessary for fabrication and erection. Check plans showing work of other trades and consult with Architect in the event of any interference.
B. Make allowances for beams, pipes or other obstructions in building construction and for work of other contractors. Transform, divide or offset ducts as required, in accordance with SMACNA HVAC Duct Construction Standards, Figure 4-7, except do not reduce duct to less than six inches in any dimension and do not exceed an 8:1 aspect ratio. Where it is necessary to take pipes or similar obstructions through ducts, construct easement as indicated in SMACNA HVAC Duct Construction Standards, Figure 4-8, Fig. E. In all cases, seal to prevent air leakage. Pipes or similar obstructions may not pass through high pressure ductwork, fume exhaust ductwork or kitchen hood exhaust ductwork.
C. Test openings for test and balance work will be provided under Section 23 05 93 – Testing, Adjusting and Balancing for HVAC.
D. Provide frames constructed of angles or channels for coils, filters, dampers or other devices installed in duct systems, and make all connections to such equipment including equipment furnished by others. Secure frames with gaskets and screws or nut, bolts and washers.
E. Install duct to pitch toward outside air intakes and drain to outside of building. Solder or seal seams to form watertight joints.
F. Where two different metal ducts meet, the joint shall be installed in such a manner that metal ducts do not contact each other by using proper seal or compound.
G. Install all motor operated dampers and connect to or install all equipment furnished by others. Blank off all unused portions of louvers, as indicated on the drawings, with 1-1/2 inch board insulation with galvanized sheet metal backing on both sides.
H. Do not install ductwork through dedicated electrical rooms or spaces unless the ductwork is serving this room or space.
I. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
J. Provide adequate access to ductwork for cleaning purposes.
K. Provide temporary capping of ductwork openings on job site, both before and after installation, to prevent entry of dirt, dust and foreign material.
L. Protect diffusers, registers and grilles with plastic wrap or some other approved form of protection to maintain dirt and dust free and to prevent entry of dirt, dust and foreign material into the ductwork.
M. Install prefabricated grease ductwork assemblies in accordance with manufacturer requirements and NFPA 96.
N. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

O. All ductwork not welded, at a minimum, shall be sealed using duct sealant or gaskets on all seams, joints and penetrations.
P. Provide 45 degree entry fitting with a minimum throat length of 25% of the width of the branch duct takeoff or 4 inches, whichever is larger.

3.02 **DUCTWORK SUPPORT**

A. Support ductwork in accordance with the latest SMACNA HVAC Duct Construction Standards, Figure 5-5, except supporting ductwork with secure wire method is not allowed.
B. Support with 3/32 inch, 7 x 7, stainless steel air-craft cable, with matching fastener rated for 50% of actual load, will be allowed on round ductwork under 12 inches if installed as detailed, with cable double looped on duct and at point of support.
C. On ductwork sections exceeding 8', provide at least two supports.

3.03 **HIGH PRESSURE DUCT (PRESSURE CLASS 3 INCH AND OVER)**

A. Seal all duct in accordance with SMACNA seal class "A". All seams, joints, and penetrations shall be sealed using duct sealant or gaskets per Part 2 - Products.

3.04 **LOW PRESSURE DUCT (MAXIMUM 2 INCH PRESSURE CLASS)**

A. Seal all duct, with the exception of transfer ducts, in accordance with SMACNA seal class "A". All seams, joints, and penetrations shall be sealed using duct sealant or gaskets per Part 2 - Products.
B. Install a manual balancing damper in each branch duct and for each diffuser or grille. The use of splitter dampers, extractors, or grille face dampers will not be accepted for balancing dampers.
C. Hangers must be wrapped around bottom edge of duct and securely fastened to duct with sheetmetal screws or pop rivets. Trapeze hangers may be used at contractor's option.

3.05 **CLEANING**

A. Remove all dirt and foreign matter from the entire duct system and clean diffusers, registers, grilles and the inside of air-handling units before operating fans.
B. Clean duct systems with high power vacuum machines where systems have been used for temporary heat, air-conditioning, or ventilation purposes during construction. Protect equipment that may be harmed by excessive dirt with filters, or bypass during cleaning.

3.06 **LEAKAGE TEST**

A. Test all ductwork in accordance with test methods described in Section 5 of SMACNA HVAC Air Duct Leakage Test Manual. Do not insulate ductwork until it has been successfully tested. Test pressure shall be equal to the duct pressure class.
B. If excessive air leakage is found locate leaks, repair duct in the area of the leak, seal duct, and retest.
C. Leakage rate shall not exceed more than 5% of the system air quantity for low pressure ductwork, determined in accordance with Appendix C of the SMACNA HVAC Air Duct Leakage Test Manual.
D. Leakage rate shall not exceed more that 1% of the system air quantity for high pressure ductwork, determined in accordance with Appendix C of the SMACNA HVAC Air Duct Leakage Test Manual.
E. Leakage test for ductwork downstream of air terminal devices may be omitted but will not relieve the contractor from duct sealing requirements.
F. Submit a signed report to the Owner, indicating test apparatus used, results of the leakage test, and any remedial work required to bring duct systems into compliance with specified leakage rates.

3.07 **STRUCTURAL TEST**

A. Random test all ductwork per owner's direction. Do not insulate ductwork until it has been successfully tested.
B. Deflection limits shall not exceed those listed in accordance with Chapter 11 of SMACNA HVAC Duct Construction Standards, 3.0 Performance Requirements.
C. Submit a signed report to the Owner, indicating test apparatus used, results of the structural test, and any remedial work required.

END OF SECTION

DUCT LEAKAGE TEST REPORT

Project Number:_____

Date Submitted:_____

Project Name: _____

Location:_____

Contractor:_____

System: **Fan No.:**_____ **Leakage Class (C_L):**_____

Data **Fan Design CFM:**_____ **Duct Pressure Class (P_c):**_____

Test Pressure (P_T):_____

Test Equipment: **Manufacturer:**_____

Model No.:_____ **Serial No.:**_____

For large systems, use the reverse side for a simple sketch of the entire duct system. Then use letter designations to indicate the various duct sections being tested at one time. Also use the reverse side for test comments.

Design Data									Field Test Data			
			Allowable Leakage		Diameter		Pressure (in. wc.)					
Duct Section	Duct Shape	Duct Surface (Ft2)	Leakage Factor ($P^{.65}C_L$)	CFM for Section	Tube (D_1)	Orifice (D_2)	In Duct (P)	Across Orifice (P_{drop})	Date	Performed By	Observed By	Actual CFM
TOTAL												

Note that due to normal construction sequencing it is usually necessary to test risers separately prior to enclosing chases.

DUCT STRUCTURAL TEST REPORT

Project Number:_____

Date Submitted:_____

Project Name: _____

Location:_____

Contractor:_____

System: **Fan No.:**_____

Description of Test Method:_____

_____

_____

Test Equipment: **Manufacturer:**_____

Model No.:_____ **Serial No.:**_____

For large systems, use the reverse side for a simple sketch of the entire duct system. Then use letter designations to indicate the various duct sections being tested at one time. Also use the reverse side for test comments.

Design Data									Field Test Data					
Duct Test Location	Ductwork Shape		Duct Pressure Class	Allowable Ductwork Wall Deflection		Allowable Joint/ Reinforcement Deflection		Pressure (in. wc.) In Duct	Measured Ductwork Wall Deflection		Measured Joint/ Reinforcement Deflection		Perfor-med By/Date	Witnes-sed By/Date
	H	W		H	W	H	W		H	W	H	W		

Note that due to normal construction sequencing it is usually necessary to test risers separately prior to enclosing chases.

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SECTION 23 33 00
AIR DUCT ACCESSORIES

PART 1 – GENERAL

1.01 SCOPE OF WORK
A. Contractor shall provide all labor and materials for a complete system in this specification section.

1.02 SECTION INCLUDES
A. This section includes accessories used in the installation of duct systems. Included are the following topics:
   1. Manual Volume Dampers
   2. Turning Vanes
   3. Fire Dampers
   4. Smoke Dampers and Combination Fire/Smoke Dampers
   5. Control Dampers
   6. Smoke Detectors
   7. Access Doors
   8. Flexible Duct
   9. Duct Lining
   10. Flashings
   11. Duct Flexible Connections
   12. Sound Attenuators

1.03 RELATED WORK
A. Applicable provisions of Division 1 govern work under this Section.
B. Section 23 05 00 – Common Work Results for HVAC
C. Section 23 05 29 – Hanger and Supports for HVAC Piping and Equipment
D. Section 23 05 48 – Vibration and Seismic Controls for HVAC Piping and Equipment
E. Section 23 09 93 – Sequence of Operations for HVAC Controls
F. Section 23 31 00 – HVAC Ducts and Casings

1.04 SUBMITTALS
A. Refer to Section 23 05 00 – Common Work Results for HVAC, Submittals. In addition to the general content specified under Section 20 05 00 – Common Work Results for HVAC, supply the following submittals:
   1. Manual Volume Dampers
   2. Turning Vanes
   3. Fire Dampers
   4. Smoke Dampers and Combination Fire/Smoke Dampers
   5. Control Dampers
   6. Smoke Detectors
   7. Access Doors
   8. Flexible Duct
   9. Duct Lining
   10. Flashings
   11. Duct Flexible Connections
   12. Sound Attenuators
B. Submit for all accessories and include dimensions, capacities, ratings, installation instructions, and appropriate identification.
C. Include certified test data on dynamic insertion loss, self-noise power levels, and aerodynamic performance of sound attenuators.
D. Submit manufacturer's color charts where finish color is specified to be selected by the Architect/Engineer.

1.05 REFERENCE STANDARDS

A. NAIMA Fibrous Glass Duct Liner Standard
B. NFPA 90A Standard for Installation of Air Conditioning and Ventilating Systems
C. SMACNA HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition, 2005
D. UL 214
E. UL 555 (6th edition) Standard for Fire Dampers and Ceiling Dampers
F. UL 555S (4th edition) Leakage Rated Dampers for Use in Smoke Control Systems

1.06 QUALITY ASSURANCE

A. Refer to Division 1 for equals and substitutions

1.07 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified in Section 23 05 00 - Common Work Results for HVAC.

PART 2 – PRODUCTS

2.01 MANUAL VOLUME DAMPERS

A. Manufacturers: Ruskin, Vent Products, Air Balance.
B. Dampers must be constructed in accordance with SMACNA Fig. 7-4, Fig. 7-5, and notes relating to these figures, except as modified below.
C. Reinforce all blades to prevent vibration, flutter, or other noise. Construct dampers in multiple sections with mullions where width is over 48 inches. Use rivets or tack welds to secure individual components; sheet metal screws will not be accepted. Provide operators with locking devices and damper position indicators for each damper; use an elevated platform on insulated ducts. Provide end bearings or bushings for all volume damper rods penetrating ductwork constructed to a 3" w.c. pressure class or above.

2.02 TURNING VANES

A. Manufacturers: Aero Dyne, Anemostat, Barber-Colman, Hart & Cooley.
B. Construct turning vanes and runners for square elbows in accordance with SMACNA Fig. 4-3 and Fig. 4-4 except use only airfoil type vanes. Construct turning vanes for short radius elbows and elbows where one dimension changes in the turn in accordance with SMACNA Chart 4-1 and Fig. 4-9.

2.03 FIRE DAMPERS

A. Manufacturers: Air Balance, Advanced Air, American Warming and Ventilating, Greenheck, Phillips-Aire, Prefco, Ruskin, Safe-Air.
B. All type B curtain type fire damper blades shall not inhibit the free area of connecting ductwork. Unless high temperature fire dampers are required, select fusible links for 160° F release.
C. Static Fire Dampers: Do not provide static fire dampers.
D. Dynamic Fire Dampers:
   1. All fire dampers shall be dynamic.
   2. Dynamic fire damper assemblies must be UL 555 (6th edition) listed and labeled for dynamic applications (where air systems operate during a fire) and meet requirements of NFPA 90A. Dampers in ducts with a wall mounted grille on one side of the wall shall be type A. Dampers in round or oval ducts shall be type C. Dampers larger than 30” by 30” or with velocity rating requirements of 3000 fpm or higher, may be multiblade type with blades located in the airstream. All other dampers shall be type B curtain dampers. Velocity ratings and static pressure ratings as indicated on the drawings. Damper fire rating to be compatible with the rating of the building assembly in which the damper is used.

2.04 SMOKE DAMPERS AND COMBINATION FIRE/SMOKE DAMPERS

A. Manufacturers: Ruskin, Johnson Controls, Air Balance, Advanced Air, American Warming and Ventilating, Greenheck, Safe-Air, Phillips-Aire, Prefco.

B. Smoke damper assemblies to be UL 555S (4th edition) listed and labeled, and leakage rated at no higher than Class II under UL 555S (4th edition). Unless ratings are indicated elsewhere, dampers should be rated for minimum 2,000 fpm air velocity and 4" static pressure.
C. Combination fire/smoke damper assemblies to be UL 555 (6th edition) and UL 555S (4th edition) listed and labeled and have a fire rating compatible with the rating of the building assembly in which the damper is used, and be leakage rated at no higher than Class II under UL 555S.
D. Provide factory installed electrically operated dampers with linkage arranged so that the damper is closed on loss of power. For electric actuation, provide electric operated dampers with linkage and UL listed operators arranged so that the damper is closed on a loss of power. Where electric actuation is controlled by the DDC system use 0-10 VDC inputs, with stall protection, and with and zero and span adjustments for modulating or 24 VAC for two-position control. Coordinate voltage with Fire Alarm Vendor. All electric actuators will be provided with overload protection to prevent motor from damage when stall condition is encountered. Locate all operators out of the air stream unless large damper size will not allow. Provide form "C" end switches to indicate damper position.
E. Use airfoil shaped damper blades on the following system:

2.05 CONTROL DAMPERS

A. Control dampers are specified in section 23 09 14.

2.06 SMOKE DETECTORS

A. Each duct smoke detector indicated on the contract documents shall be installed in cooperation with the electrical contractors. Duct detector locations shown are diagrammatic only and require pressure differential testing to insure proper smoke detector operation. Each duct detector housing and sampling tube kit installed shall be mounted and tested prior to the installation of the duct smoke detector. Air sampling tube installation shall be tested per the manufacturer's written instructions.
B. The Electrical contractor shall furnish the duct detector assembly and sampling tube kits sized for the installation locations indicated on the mechanical ductwork drawings. This contractor shall maintain possession of the duct detector smoke detection device.
C. The Electrical contractor shall provide smoke detector installation, interconnecting cabling, and testing of the smoke detection system in accordance with the specification.
D. Contractor shall install detector housing and sampling tubes in accordance with the listing manufacturer's installation instructions, project documentation, and provide differential pressure testing and adjustments as described in Section 3 – Execution.

2.07 ACCESS DOORS

A. Access door to be designed and constructed for the pressure class of the duct in which the door is to be installed. Doors in exposed areas shall be hinged type with cam sash lock. Hinges shall be steel full length continuous piano type. Doors in concealed spaces may be secured in place with cam sash latches. For both hinged and non-hinged doors provide sufficient number of camp sash latches to provide air tight seal when door is closed. Do not use hinged doors in concealed spaces if this will restrict access. Use minimum 1" deep 24 gauge galvanized steel double wall access doors with minimum 24 gauge galvanized steel frames. For non-galvanized ductwork, use minimum 1" deep double wall access door with frame that shall use materials of construction identical to adjacent ductwork. Provide double neoprene gasket that shall provide seals from the frame to the door and frame to the duct. When access doors are installed in insulated ductwork or equipment provide insulated doors with insulation equivalent to what is provided for adjacent ductwork or equipment. Access doors constructed with sheet metal screw fasteners will not be accepted.
B. Use insulated 1-1/2 hour UL 1978 listed and labeled access doors in kitchen exhaust ducts.

2.08 FLEXIBLE DUCT

A. Manufacturers: Anco Products, Clevaflex, Thermaflex, Flexmaster, Hart and Cooley.
B. Factory fabricated , UL 181 listed as a class 1 duct, and having a flame spread of 25 or less and a smoke developed rating of 50 or under in accordance with NFPA 90A.
C. Suitable for pressures and temperatures involved but not less than a 180°F service temperature and ±2 inch pressure class, depending on the application.

D. Duct to be composed of polyester film, aluminum laminate or woven and coated fiberglass fabric bonded permanently to corrosion resistant coated steel wire helix. Two-ply, laminated, and corrugated aluminum construction may also be used.
E. Where duct is specified to be insulated, provide a minimum 1 inch fiberglass insulation blanket with maximum thermal conductance of 0.23 K (75 degrees F.) and vapor barrier jacket of polyethylene or metalized reinforced film laminate. Maximum perm rating of vapor barrier jacket to be 0.1 perm.

2.09 DUCT LINING

A. Manufacturer: Manville, Owens-Corning, Knauf.
B. 1 inch thick, flexible, mat faced insulation made from inorganic glass fibers bonded with a thermosetting resin with thermal conductivity of .25 Btu inch / hour sq. ft. deg F.
C. Meet erosion testing per UL 181 or ASTM C 1071 for 5000 fpm maximum air velocity. ASTM C 411 maximum operating temperature rating of 250 deg F. ASTM E84 flame spread less than 25 and smoke developed less than 50.
D. Meet requirements of ASTM C 1338 and ASTM G21 for fungi resistance.
E. Install liner using adhesive conforming to ASTM C 916.

2.10 FLASHINGS

A. Provide flashing to completely weatherproof connection of ductwork to louvers. Flashing to be constructed of material similar to louver material.
B. Flashing and counterflashing for roof curbs will be provided by others.
C. Flashing and curbs for duct and pipe penetrations of roof assemblies to be in accordance with details.

2.11 DUCT FLEXIBLE CONNECTIONS

A. Material shall be fire retardant, shall be UL 214 listed, and shall meet the requirements of NFPA 90A.
B. Connections to be a minimum of 3 inches wide, crimped into metal edging strip, and air tight. Connections to have adequate flexibility and width to allow for thermal expansion/contraction, vibration of connected equipment, and other movement.
C. Use coated glass fiber fabric for all applications. Material for inside applications other than corrosive environments, fume exhaust, or kitchen exhaust to be double coated with neoprene, air and water tight, suitable for temperatures between -10°F and 200°F and have a nominal weight of 30 ounces per square yard. Material used for outdoor applications other than corrosive environments, fume exhaust, or kitchen exhaust to be double coated with Elastomer, air and water tight, suitable for temperatures between -10°F and 250°F and have a nominal weight of 26 ounces per square yard.

2.12 SOUND ATTENUATORS

A. Manufacturers: Industrial Acoustics Company, Environmental Elements Corporation, Semco, Dynasonics, United McGill, Price.
B. Construct of a 22 gauge galvanized steel outer casing, and 26 gauge galvanized, perforated steel inner liner. Seams and joints of outer casing to be air tight.
C. Fill annular space between outer casing and inner liner with acoustic fill that is inert, inorganic, and of a density sufficient to obtain the specified acoustic performance. Material must meet requirements of NFPA 90A with a flame spread index of 25 or less and smoke developed rating of 50 or less.
D. Acoustical and aerodynamic performance is indicated on schedules on the drawings.
E. Equalizing air deflector shall be operated with worm drive mechanism accessible through the face of diffuser or register with an 18 inch removable key operator.

PART 3 – EXECUTION

3.01 MANUAL VOLUME DAMPERS

A. Install manual volume dampers in each branch duct and for each grille, register, or diffuser as far away from the outlet as possible while still maintaining accessibility to the damper. Install so there is no flutter or vibration of the damper blade(s).

3.02 TURNING VANES

A. Install turning vanes in all rectangular, mitered elbows in accordance with the latest SMACNA standards and/or manufacturer's recommendations.
B. Install double wall, airfoil, 2 inch radius vanes in ducts with vane runner length 18" or greater and air velocity less than 2000 fpm. Install double wall, airfoil, 4-1/2 inch radius vanes in ducts with vane runner length 18" or greater and air velocity 2000 fpm or greater.
C. If duct size changes in a mitered elbow, use single wall type vanes with a trailing edge extension. If duct size changes in a radius elbow or if short radius elbows must be used, install sheetmetal turning vanes in accordance with SMACNA Chart 4-1 and Fig. 4-9.

3.03 FIRE DAMPERS

A. Install dampers in strict accordance with manufacturer's installation instructions. Install damper sleeves with retaining angles per UL listing. Connections of ductwork to fire damper assemblies to be as specified on the installation instructions. Where it is necessary to set dampers out from the rated wall, install a sleeve extension encased in two hour rated fire proofing insulation. Install an access door at each fire damper, located to permit resetting the damper replacing the fusible link.
B. Manually test each fire damper for proper operation by removing the fusible link. Repair or replace any fire damper that does not close completely. Re-install fusible link after test.

3.04 SMOKE DAMPERS AND COMBINATION FIRE/SMOKE DAMPERS

A. Install smoke dampers in locations indicated on the drawings in accordance with the manufacturer's instructions. Install an access door adjacent to each damper for inspection and cleaning. Coordinate damper linkage with operators so the dampers are closed when the air system is not operating.
B. Install combination fire/smoke dampers as specified above for fire dampers. Coordinate damper linkage with operators so the dampers are closed when the air system is not operating.

3.05 CONTROL DAMPERS

A. Install dampers in locations indicated on the drawings, as detailed, and according to the manufacturer's instructions. Install blank-off plates or transitions where required for proper mixing of airstreams in mixing plenums. Provide adequate operating clearance and access to the operator. Install an access door adjacent to each control damper for inspection and maintenance.

3.06 SMOKE DETECTORS

A. Duct smoke detector assemblies shall be tested and installed in accordance with the following:
   1. Post air system balancing – testing and adjusting for proper operation shall be done by the installing contractor with a pressure differential manometer.
   2. The differential pressure readings taken across the duct detector housing inlet and return tube shall be between 0.06 minimum and 1.28 maximum inches of water. Provide adjustment to sampling tube as needed to accomplish required pressure differential.
   3. Provide a written record of readings. Submit to the project engineer for review and acceptance prior to the final installation of the duct smoke detector.
   4. Initial tests shall be conducted to qualify installation location suitability. If initial testing concludes appropriate pressure differential may be available, contractor shall install the duct detector assembly complete in accordance with the installation details.
   5. If acceptable differential pressure readings are not obtained, the inlet sampling tube may be rotated until the proper differential pressure readings are obtained. If inlet sampling tube rotation does not yield the proper differential pressure reading, the duct detector assembly shall be relocated further downstream at no additional cost to the owner.
B. Final installation wiring of the duct smoke detector shall not be completed by the electrical contractor until after the proper differential pressure reading has been obtained, documented, and approved.
C. Installation Requirements:
   1. In addition to the manufactures instructions the following guidelines will be enforced:
      a. Duct detector may be installed in any wall of the duct unless otherwise restricted by the manufacturer’s instructions.

b. Cut inlet sampling tube length to suite dimension of duct. If duct is more than 18" wide drill an appropriate diameter hole directly opposite to support inlet sampling tube of lengths longer than 18". Sampling tube shall protrude no longer than 1" outside of duct wall.
c. Contractor to note that air inlet sampling tubes are designed for differing duct widths employing air inlet holes in a quantity matching the duct width. Verify each inlet tube is appropriately sized for the duct width (typically 10 to 12 holes, each 0.193" diameter holes [#11 drill bit]).
d. Angle cut return tube at a length as recommended by manufacturer if required. Support in accordance with manufacturer's recommendations.
e. Position inlet holes facing upstream of airflow. This initial installation position shall be used as the starting point for differential pressure testing. If required adjust as stated in the testing/adjusting procedure above. Angle cut of return tube shall be orientated downstream of airflow.
f. Once acceptable differential pressure readings are obtained, tubes shall be locked in place in accordance with the manufacturer's installation instructions.
g. Duct detector assembly and sampling tubes shall be mounted rigidly to prevent noise, chatter, and mechanical fatigue. Any installation found unacceptable will be corrected at the installing contractor's expense.
h. Inlet tubes installed protruding through duct walls greater in width of 18" shall have the sampling tube end plugged with the manufacturer furnished air stopper.
i. Air leaks are unacceptable, the installing contractor shall provide gaskets, or duct sealant around inlet and outlet air tubes. Sealing around detector housing perimeter is not acceptable. Seal all duct wall penetration to pressure class rating of duct assembly.
j. Once the detector is installed, verify correct differential pressure readings across sampling tubes and record. Install manufacturer furnished sampling tube filters.
k. If duct is insulated, provide detector housing standoffs, equivalent in depth of the duct wall insulation, to rigidly support detector assembly. Seal any sampling tube air holes that are not inside duct wall and duct sealant and tape.
l. At each duct detector installation location provide a service opening. Include a minimum 12" x 12" access door as specified in division 23.

2. After assembly is installed and tested, coordinate with electrical contractor and fire alarm vendor for smoke detector installation.

3.07 ACCESS DOORS

A. Install access doors where specified, indicated on the drawings, and in locations where maintenance, service, cleaning or inspection is required. Examples include, but are not limited to motorized dampers, fire and smoke dampers, smoke detectors, fan bearings, heating and cooling coils, filters, valves, and control devices needing periodic maintenance.
B. Size and numbers of duct access doors to be sufficient to perform the intended service. Minimum access door size shall be 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, or other size as indicated. Install access doors on both inlet and outlet sides of reheat coils as well as other duct mounted coils.
C. Label fire, smoke and combination fire smoke dampers on the exterior surface of ductwork directly adjacent to access doors using a minimum of 0.5 inch height lettering reading, "SMOKE DAMPER" or "FIRE DAMPER". Smoke and combination fire smoke dampers shall also include a second line listing the individual damper tag. The tags must be coordinated with the mechanical schedules. Utilize stencils or manufactured labels. All other forms of identification are unacceptable. All labels shall be clearly visible from the ceiling access point.

3.09 FLEXIBLE DUCT

A. Flexible duct may only be used for final connections of air inlets and outlets at diffuser, register, and grille locations. Where flexible duct is used, it shall be the minimum length required to make the final connections, but no greater than 6 feet in length, and have no more than one (1) 90 degree bend.
B. Secure inner jacket of flexible duct in place with stainless steel metal band clamp. Secure insulation vapor barrier jacket in place with steel or nylon draw band. Sheetmetal screws and/or duct tape will not be accepted.

C. Flexible duct used to compensate for misalignment of main duct or branch duct will not be accepted.
D. Individual sections of flexible ductwork shall be of one piece construction. Splicing of short sections will not be accepted.
E. Flexible ductwork used as transfer duct shall be sized for a maximum velocity of 300 fpm.
F. Penetration of any partition, wall, or floor with flexible duct will not be accepted.

3.10 DUCT LINING

A. Apply lining to the following ductwork:
B. Install liner in compliance with the latest edition of NAIMA's Fibrous Glass Duct Liner Standard. Locate longitudinal joints at the corners of duct only. Cut and fit to assure lapped, compressed joints. Coat all transverse and longitudinal joints and edges with adhesive. Provide metal nosing on leading edge where lined duct is preceded by unlined duct. Adhere liner to duct with full coverage area of adhesive. Additionally, secure liner to duct using mechanical fasteners spaced as recommended by the liner manufacturer without compressing liner more than 1/8" with the fasteners.

3.11 FLASHINGS

A. Flashing for roof curbs, equipment supports, or rails located on roof will be installed by others.

3.12 DUCT FLEXIBLE CONNECTIONS

A. Install at all duct connections to rotating or vibrating equipment, including air handling units (unless unit is internally isolated), fans, or other motorized equipment in accordance with SMACNA Figure7-10. Install thrust restraints to prevent excess strain on duct flexible connections at fan inlets and outlets; see Related Work.
B. For applications in corrosive environments or fume exhaust systems, use a double layer of the Teflon coated fabric when making the connector.

3.13 SOUND ATTENUATORS

A. Install sound attenuators in locations indicated on the drawings. Where modular installation is required, install units in a galvanized steel frame equipped with gaskets or seals between modules to prevent bypass of air.

3.14 TRAINING

A. See Section 23 05 00 – Common Work Results for HVAC for general training requirements.
B. In addition to the training provided in Section 23 05 00 – Common Work Results for HVAC, provide an additional 1 hours of training for each type of duct accessory provided on the project.

END OF SECTION

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SECTION 23 34 00
HVAC FANS

PART 1 – GENERAL

1.01 SCOPE OF WORK
A. Contractor shall provide all labor and materials for a complete system in this specification section.

1.02 SECTION INCLUDES
A. This section includes specifications for fans that are not an integral part of a manufactured device. Included are the following topics:
   1. Centrifugal Fans
   2. In-line Centrifugal Fans
   3. Power Roof Exhaust Fans

1.03 RELATED WORK
A. Applicable provisions of Division 1 govern work under this Section.
B. Section 23 05 00 – Common Work Results for HVAC
C. Section 23 05 13 – Common Motor Requirements for HVAC Equipment
D. Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment
E. Section 23 05 48 – Vibration and Seismic Controls for HVAC Piping and Equipment
F. Section 23 09 93 – Sequence of Operations for HVAC Controls

1.04 SUBMITTALS
A. Refer to Section 23 05 00 – Common Work Results for HVAC, Submittals. In addition to the general content specified under Section 20 05 00 – Common Work Results for HVAC, supply the following submittals:
   1. Centrifugal Fans
   2. In-line Centrifugal Fans
   3. Power Roof Exhaust Fans
B. Include dimensions, capacities, fan curves, materials of construction, ratings, weights, motors and drives, sound power levels, appropriate identification and vibration isolation for all equipment. Sound power levels to be based on tests performed in accordance with AMCA Standard 300.
C. Submit color selection charts for equipment where applicable.
D. Fan curves shall indicate the relationship of CFM to static or total pressure for various fan speeds. Maximum and minimum RPM curves shall be displayed on fan curve. Brake horsepower, recommended selection range, and limits of operation are to also be indicated on the curves. Indicate operating point on the fan curves at design air quantity and indicate the manufacturer's recommended drive loss factor for the specific application. Tabular fan performance data is not acceptable.
E. For variable air volume application, include data which indicates the effect of capacity control devices, such as inlet vanes, on performance.

1.05 REFERENCE STANDARDS
A. AMCA 203 AMCA Fan Application Manual - Troubleshooting
B. AMCA 210 Laboratory Method of Testing Fans for Rating
C. AMCA 300 Reverberant Room Method for Sound Testing of Fans
D. NFPA 90A Standard for the Installation of Air Conditioning and Ventilating Systems
E. NFPA 96 Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations
F. UL 762 Power Roof Ventilators for Restaurant Exhaust Appliances

1.06 QUALITY ASSURANCE
A. Refer to Division 1 for equals and substitutions.

1.07 DESIGN CRITERIA

A. Tested and certify all fans in accordance with the applicable AMCA test code.
B. Each fan and motor combination shall be capable of delivering 110% of air quantity scheduled at scheduled static pressure. The motor furnished with the fan shall not operate into the motor service factor when operating under these conditions.
C. Consider drive efficiency in motor selection according to manufacturer's published recommendation or according to AMCA Publication 203, Appendix L.
D. Where inlet and outlet ductwork at any fan is changed from that shown on the drawings, provide any motor, drive and/or wiring changes required due to increased static pressure or baffling necessary to prevent uneven airflow or improve mixing.
E. All internal insulation and other components exposed to the airstream are to meet the flame spread and smoke ratings contained in NFPA 90A.
F. All roof mounted equipment to be provided with curbs or equipment stands in accordance with specification in Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment.

1.08 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified in Section 23 05 00 – Common Work Results for HVAC.

PART 2 – PRODUCTS

2.01 GENERAL

A. Use fan size, class, type, arrangement, and capacity as scheduled.
B. Furnish complete with motors, wheels, drive assemblies, bearings, vibration isolation devices, and accessories required for specified performance and proper operation. All single phase motors to have inherent thermal overload protection.
C. Provide variable pitch sheaves for drives 3 hp and smaller, fixed pitch sheaves for drives 5 hp and larger. Design all drives for 150% of motor rating.
D. Use OSHA approved belt guards that totally enclose the entire drive. Construct guards of expanded metal to allow for ventilation; provide tachometer openings at shaft locations.
E. Statically and dynamically balance all fans so they operate without objectionable noise or vibration.
F. Use AMCA Type A spark resistant construction for all fans handling flammable or explosive vapors.
G. All fans handling grease laden vapors shall meet the requirements of UL 762 and NFPA 96.
H. Provide a corrosion resistant coating on all surfaces exposed to fume and other corrosive exhaust air. Coating to be as scheduled.

2.02 CENTRIFUGAL FANS

A. Manufacturers: PennBarry, Peerless, Buffalo, Carrier, Champion, Chicago Blower, Greenheck, New York Blower, Trane, Twin City, Cook.
B. Construct housing of welded steel with angle iron frame. Use spun or die formed inlet cones to provide a streamlined flow into the wheel. Use airfoil blades welded to spun wheel cones unless otherwise indicated. Shafts shall be AISI C 1045 hot rolled steel turned, ground and polished. Shaft shall be sized for at least 125% of the fans maximum cataloged RPM.
C. Bearings to be self-aligning grease packed pillow block type with grease seal and external grease fittings with a minimum L50 life of 200,000 hours at the maximum cataloged operating speed. Provide each fan housing with a capped drain connection and bolted and gasketed access door for inspection of fan wheel. Unless a special coating is scheduled, paint fans with a prime coat after metal cleaning and surface preparation; apply a second coat of paint to all exterior surfaces.
D. Fans shall bear the AMCA Certified Ratings Seal for Sound and Air Performance.
E. Provide one inch galvanized mesh inlet screens for fans without inlet ductwork.

2.03 IN-LINE CENTRIFUGAL FANS

A. Manufacturers: Acme, PennBarry, Cook, Greenheck, New York Blower, Peerless, Penn, Twin City.

B. Construct housing of welded steel with reinforcing to prevent distortion. Furnish with streamlined inlet cones and multiple straightening vanes following the fan wheel to minimize noise and reduce turbulence. Provide each housing with a bolted and gasketed access door for inspection of drive and fan wheel. Use non-overloading airfoil blade fans welded to the wheel cones. Isolate belt drives from airstream with a belt tube. Externally mount motors on an adjustable base. Bearings to be grease lubricated, self-aligning ball bearing type with grease seal and external grease fitting. Unless a special coating is scheduled, paint fans with a prime coat after metal cleaning and surface preparation. Apply a second coat of paint to all exterior surfaces.
C. Design all vertically mounted fans to withstand the vertical thrust loads.
D. Provide variable inlet vanes for fans as scheduled. Vane bearings shall have grease fittings extended to an accessible location.
E. Provide one inch galvanized mesh inlet screens for fans without inlet ductwork.

2.04 POWER ROOF EXHAUST FANS

A. Manufacturers: Carnes, Greenheck, Penn, Jenn-Air, Cook, ACME.
B. Provide upblast or downblast units, as scheduled, with aluminum housing, non-overloading type centrifugal wheel, inlet cone, factory mounted and wired motor and disconnect switch, and bird screen.
C. Electrical Contractor will provide disconnect switches and thermal overload protection for units with three phase motors.
D. Upblast units to have motor, bearings, and drives completely enclosed and isolated from the exhaust air stream with ventilation provided by outside air. Units handling grease laden vapors to be U.L. listed for conveying such vapors, operating continuously at 300 degrees F.
E. See Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment for roof curb information.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install as shown on the drawings, as detailed, and according to manufacturer's installation instructions. On units provided with a drain connection, reduce drain connection down to ½" fitting and leave open.
B. Install thrust restraints in accordance with the requirements of Section 23 05 48 – Vibration and Seismic Controls for HVAC Piping and Equipment.
C. Contractor shall balance blade assembly of destratification fans after installation to assure stable operation.

3.02 TRAINING

A. See Section 23 05 00 – Common Work Results for HVAC for general training requirements.
B. In addition to the training provided in Section 23 05 00, provide an additional 1 hour of training for each type of fan provided on the project.

END OF SECTION

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SECTION 23 36 00
AIR TERMINAL UNITS

PART 1 **- GENERAL**

1.01 SCOPE OF WORK
A. Contractor shall provide all labor and materials for a complete system in this specification section.

1.02 SECTION INCLUDES
A. This section includes specifications for air terminal equipment. Included are the following topics:
   1. Supply Variable Air Volume Boxes
   2. Terminal Air Box Valve Controls
   3. Terminal Unit Insulation

1.03 RELATED WORK
A. Applicable provisions of Division 1 govern work under this section.
B. Section 23 05 00 – Common Work Results for HVAC
C. Section 23 05 93 – Testing, Adjusting and Balancing for HVAC
D. Section 23 09 14 – Pneumatic and Electric Instrumentation and Control Devices for HVAC
E. Section 23 09 93 – Sequence of Operation for HVAC Controls
F. Section 23 31 00 – HVAC Ducts and Casings
G. Section 23 33 00 – Air Duct Accessories
H. Section 23 82 00 – Heating and Cooling Terminal Units

1.04 SUBMITTALS
A. Refer to Section 23 05 00 – Common Work Results for HVAC, Submittals. In addition to the general content specified under Section 23 05 00 – Common Work Results for HVAC, supply the following submittals:
   1. Supply Variable Air Volume Boxes
   2. Terminal Unit Insulation
B. Contractor shall submit air terminal unit data including materials of construction, dimensions, scheduled flow rates, pressure drops, radiated and discharge sound power levels, reset volume controller data, actuator spring range and torque data.

1.05 REFERENCE STANDARDS
A. NFPA 90A — Installation of Air Conditioning and Ventilation Systems.
B. UL 181 — Factory-Made Air Ducts and Connectors.
C. ARI-ADC — Standard 880
D. ASTM E84 — Surface Burning Characteristics of Building Materials
E. UL 723 — Surface Burning Characteristics of Building Materials

1.06 QUALITY ASSURANCE
A. Refer to Division 1 for equals and substitutions.

1.07 DESIGN CRITERIA
A. Select sizes, capacities, configuration, and operating characteristics as shown on the plans and/or as scheduled.

1.08 OPERATION AND MAINTENANCE DATA
A. All operations and maintenance data shall comply with the submission and content requirements specified in Section 23 05 00 – Common Work Results for HVAC.

PART 2 **- PRODUCTS**

2.01 **SUPPLY VARIABLE AIR VOLUME BOXES**

A. Units shall be single duct and pressure independent.
B. Manufacturers: Carnes, Envirotec, Krueger, Metal-Aire, Nailor, Titus, Trane, Price.
C. Construction:
   1. Unit casing shall be minimum 22 gauge steel and internally insulated with 13/16" rigid fiberglass insulation with a foil scrim face or ¾" thick polyolefin closed cell insulation. Construction to meet UL 181 and NFPA 90A. Casing shall be sealed to limit leakage to a maximum of 15 cfm at 6.0 inches of static pressure. Casing outlet shall have slip and drive joint for connection to discharge ductwork.
   2. Metal damper blade shall be mounted to shaft having self-lubricated bearings. Shaft end shall be marked to indicate damper position and shall have a built-in stop to prevent overstroking. Damper blade shall close off against gasket to limit leakage to 10 cfm at 6.0 inches of differential static pressure. Damper linkage shall be sized to accept at least 40 inch-pounds of torque to the damper shaft. Damper shaft shall be provided with a marking indicating damper position.
   3. Round inlet collar shall be equipped with a multi-point flow sensor that shall amplify the measured velocity pressure. Pneumatic tubing from flow sensor to differential pressure transducer shall be UL listed, fire retardant (FR) type.
D. Hot Water Reheat Coil: Reference section 23 82 00 for Heating and Cooling Terminal Units hot water reheat coil specifications.

2.02 **TERMINAL AIR BOX VALVE CONTROLS**

A. DDC Controls:
   1. Butterfly Damper Terminal Air Box: Damper actuator and differential pressure sensor for flow measurement shall be provided under Section 23 09 14 – Pneumatic and Electric Instrumentation and Control Devices for HVAC.

2.03 **ACCESS DOORS**

A. Refer to Section 23 33 00 – Air Duct Accessories for Access Doors.

2.04 **TERMINAL UNIT INSULATION**

A. Materials or accessories containing asbestos will not be accepted.
B. Use composite insulation systems (insulation, jackets, sealants, and adhesives) that have a flame spread rating of 25 or less and smoke developed rating of 50 or less.
C. The following two internal insulation options may be utilized.
D. Rigid Fiberglass Insulation:
   1. Minimum nominal density of 3 lbs. per cu. ft., and thermal conductivity of not more than 0.23 at 75 degrees F, minimum compressive strength of 25 PSF at 10% deformation, rated for service to 450 degrees F.
   2. Foil-scrim-kraft vapor barrier jacket, factory applied to insulation, maximum permeance of .02 perms. All exposed insulation edges shall be covered with metal nosing.
E. Polyolefin Insulation: Flexible closed cell, minimum nominal density of 1.5 lbs. per cu. ft., thermal conductivity of not more than 0.24 at 75 degrees F, minimum compressive strength of 5 psi at 25% deformation, maximum water vapor permeability of 0.0 perm inch, maximum water absorption of 0% by weight and volume, rated for service range of -165 degrees F to 210 degrees F.

PART 3 **- EXECUTION**

3.01 **INSTALLATION**

A. Install air terminal units as indicated on project drawings and in accordance with the manufacturer's installation instructions.
B. Mount air terminal boxes with a minimum 3 feet of straight ductwork upstream of inlet flow sensor for sizes 12" diameter and below. Provide a minimum of 3X the inlet diameter of straight duct upstream of the inlet flow sensor for inlet sizes above 12" diameter.

C. Factory mount coil in supply air terminal unit. Where indicated on drawings field mount coil separate from box with a 12-18" section of duct between the air terminal box and reheat coil. The reheat coil and 12-18" section of duct shall be wrapped with external insulation as indicated in specification section 23 07 00 – HVAC Insulation.
D. Provide at least 24" of clearance on controller side of the air terminal unit. The clearance area shall extend the full length of the supply air terminal unit and the full length (including the access door) of the air terminal unit
E. Support air terminal units from building structure using sheet metal straps or trapeze hanger with rods. Do not mount air terminal units off of adjacent ductwork or piping.
F. Access Doors:
   1. Duct Access Doors – Square Duct: Provide duct access doors in duct or extended supply air terminal unit upstream and downstream of the reheat coil. Duct access doors shall be as large as duct allows with a maximum size of 18"x18". Install heating coils in accordance with Section 23 73 12 - Air Handling Unit Coils.
   2. Duct Access Doors – Round Duct: Install round duct access doors on the side of the duct upstream of the return/exhaust terminal unit. At no time shall the access door be installed in the bottom of the duct. Piano hinged style access doors shall be installed with the piano hinges located ½ above the bottom of the duct to allow the access door to swing down toward the floor.
G. Insulation:
   1. Rigid Fiberglass Insulation: All rigid duct insulation edges shall be covered with metal nosing. Foil scrim face must completely separate the rigid fiberglass duct material from the air stream.
   2. Polyolefin Insulation:
      a. Apply full cover coat of adhesive to surface to be insulated, insulation and edge butt joints. Place insulation with edge joints firmly butted pressing to surface for full adhesion. Seal seams and joints vapor tight.
      b. For supply air terminal units, provide five feet of 1" thick lining immediately downstream from air terminal unit discharge. Where hot water reheat coils are field or factory installed, provide five feet of 1" thick lining in ductwork immediately downstream of reheat coil. Refer to Section 23 33 00 – Air Duct Accessories for liner specification.

3.02 **ADJUSTING**

A. Coordinate adjustment of air terminal units with Section 23 05 93 - Testing, Adjusting and Balancing.

3.03 **TRAINING**

A. See Section 23 05 00 – Common Work Results for HVAC for general training requirements.
B. In addition to the training provided in Section 23 05 00 – Common Work Results for HVAC, provide an additional 1 hour of training for each type of terminal unit provided on the project.

END OF SECTION

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SECTION 23 37 13
DIFFUSERS, REGISTERS & GRILLES

PART 1 - GENERAL

1.01 SCOPE OF WORK
A. Contractor shall provide all labor and materials for a complete system in this specification section.

1.02 SECTION INCLUDES
A. This section includes specifications for air terminal equipment. Included are the following topics:
   1. Square Ceiling Diffusers - Plaque
   2. Plenum Slot Diffusers - 180 Degree Adjustable
   3. Plenum Slot Diffusers – with Gasketed Blade
   4. Side-Wall Registers and Grilles

1.03 RELATED WORK
A. Applicable provisions of Division 1 govern work under this section.
B. Section 23 05 00 – Common Work Results for HVAC
C. Section 23 05 93 – Testing, Adjusting and Balancing for HVAC
D. Section 23 31 00 – HVAC Ducts and Casings
E. Section 23 33 00 – Air Duct Accessories

1.04 SUBMITTALS
A. Refer to Section 23 05 00 – Common Work Results for HVAC, Submittals. In addition to the general content specified under Section 20 05 00 – Common Work Results for HVAC, supply the following submittals:
   1. Square Ceiling Diffusers - Plaque
   2. Plenum Slot Diffusers - 180 Degree Adjustable
   3. Plenum Slot Diffusers – with Gasketed Blade
   4. Side-Wall Registers and Grilles
B. Furnish submittal information including, but not limited to, the following:
   1. Manufacturer's name and model number
   2. Identification as referenced in the documents
   3. Capacities/ratings
   4. Materials of construction
   5. Sound ratings
   6. Dimensions
   7. Finish
   8. Color selection charts where applicable
   9. Manufacturer's installation instructions
   10. All other appropriate data

1.05 REFERENCE STANDARDS
A. NFPA 90A — Installation of Air Conditioning and Ventilation Systems.
B. UL 181 — Factory-Made Air Ducts and Connectors.
C. ARI-ADC Standard 880

1.06 QUALITY ASSURANCE
A. Refer to Division 1 for equals and substitutions.

1.07 DESIGN CRITERIA
A. All performance data shall be based on tests conducted in accordance with Air Diffusion Council (ADC) Test Code 1062 GRD 84.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Carnes, Krueger, Titus, Metal-Aire, and E.H. Price, and United Sheet Metal.
B. Acceptable manufacturers for specific products are listed under each item.

2.02 SQUARE CEILING DIFFUSERS - PLAQUE

A. Titus model OMNI, Carnes series SFPA/SHPA, Price model SMDP, Metal Aire series 5750, and Krueger series PLQ/5PLQ.
B. Aluminum unless otherwise indicated, louvered face furnished with frame type appropriate to installation. Refer to architectural plan for ceiling installation conditions types. It is the responsibility of the contractor to coordinate frame and border of diffusers with general contractor.
C. Directional blow pattern as shown on the drawings and/or as scheduled.
D. One-piece removable square face plaque with one-piece backpan.
E. White, baked enamel finish or powder coat finish, unless otherwise indicated.

2.03 PLENUM SLOT DIFFUSER – 180 DEGREE ADJUSTABLE

A. Titus model TBD-30, Carnes model DA, Price model TBD3, Metal Aire series 6600, and Krueger series PTBA, Raymon-Donco Series SAT/XC.
B. Steel, furnished with T-bars compatible with ceiling components. Vane air pattern and flow rate adjustment with air pattern having full 180-degree adjustment.
C. Refer to architectural plan for ceiling installation conditions types. It is the responsibility of the contractor to coordinate frame and border of diffusers with general contractor.
D. Provide 24 gauge galvanized steel uninsulated plenum. Provide round or oval inlet collar designed to fit standard flexible duct sizes.
E. Double metal thickness slot face.
F. White, baked enamel finish or powder coat finish, unless otherwise indicated. Flat black diffuser vanes and frame interior.

2.04 PLENUM SLOT DIFFUSER - WITH GASKETED BLADE

A. Titus model TBD-80, Carnes model DA, Price model TBD4, Metal Aire series PHP, and Krueger series PTBS, Raymon-Donco Series BA/BS.
B. Steel, furnished with T-bars compatible with ceiling components. Extruded aluminum pattern with a gasket on top edge to form a seal against the plenum wall or slot divider. Pattern control field adjustable from vertical to horizontal discharge.
C. Provide 24 gauge galvanized steel uninsulated plenum. Provide round or oval inlet collar designed to fit standard flexible duct sizes.
D. Double metal thickness slot face.
E. White, baked enamel finish or powder coat finish, unless otherwise indicated. Flat black diffuser vanes and frame interior. Refer to architectural plan for ceiling installation conditions types. It is the responsibility of the contractor to coordinate frame and border of diffusers with general contractor.

2.05 SIDE-WALL REGISTERS AND GRILLES

A. Titus series 300 (supply) and series 350 (return/exhaust), Carnes model R series, Price model 520 (Supply) or 530 (return/exhaust), Metal Aire series V4000 or H4000, Krueger series 880.
B. Aluminum unless otherwise indicated, with frame type appropriate to installation. Refer to architectural plan for ceiling installation conditions types. It is the responsibility of the contractor to coordinate frame and border of diffusers with general contractor.
C. Double deflection type blade supply registers and supply grilles allow deflection adjustment in all direction.
D. Opposed blade volume control damper supply registers, operable from face.
E. Fixed blade 45 degree core return and exhaust registers and grilles.
F. Opposed blade volume control damper return registers, operable from face.
G. Register and grille sizes as shown on drawings and/or as scheduled.
H. White, baked enamel finish or powder coat finish, unless otherwise indicated.
I. Screw holes on surface counter sunk to accept recessed type screws.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install grilles, registers and diffusers as shown on drawings and according to manufacturer's instructions.
B. Furnish diffusers with equalizing grids where it is not possible to maintain minimum 2 duct diameter straight duct into diffuser. Equalizing grids shall consist of individually adjustable vanes designed for equalizing airflow into diffuser neck and providing directional control of airflow.
C. Unless otherwise indicated, size ductwork drops to diffusers or grilles to match unit collar size.
D. Seal connections between ductwork drops and diffusers/grilles airtight.
E. Blank off unused portion of linear slot diffusers and linear bar diffusers and grilles.
F. Where diffusers, registers and grilles cannot be installed to avoid seeing inside duct, paint inside of duct with flat black paint to reduce visibility.

END OF SECTION

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SECTION 23 41 00
PARTICULATE AIR FILTRATION

PART 1 - GENERAL

1.01 SCOPE OF WORK
A. Unless noted otherwise or referenced from another specification section by a different contractor, the Contractor shall provide all labor and materials for a complete system in this specification section.

1.02 SECTION INCLUDES
A. This section includes specifications for air system filters. Included are the following topics:
   1. Panel Filters
   2. MERV 7 Filters
   3. Housings for Panel Filters
   4. Housings for MERV 7 Filters

1.03 RELATED WORK
A. Applicable provisions of Division 1 govern work under this section.
B. Section 23 05 00 – Common Work Results for HVAC
C. Section 23 07 00 – HVAC Insulation
D. Section 23 74 13 – Roof Top Air-Handling Units

1.04 SUBMITTALS
A. Refer to Section 23 05 00 – Common Work Results for HVAC, Submittals. In addition to the general content specified under Section 20 05 00 – Common Work Results for HVAC, supply the following submittals:
   1. Panel Filters
   2. MERV 7 Filters
   3. Housings for Panel Filters
   4. Housings for MERV 7 Filters
B. Include data concerning dimensions, materials, efficiencies, installation instructions and appropriate identification.
C. Independent test reports verifying filter performance, test procedures and ratings.

1.05 REFERENCE STANDARDS
A. ASHRAE Standard 52
B. UL 181 – Standard for Factory-Made Air Ducts and Air Connectors
C. UL 586 – Standard for High Efficiency Particulate Air Filter Units
D. UL 900 – Standard for Air Filter Units

1.06 QUALITY ASSURANCE
A. Refer to Division 1 for equals and substitutions.

1.07 DESIGN CRITERIA
A. Use UL Class 1 or Class 2 filters unless noted otherwise.(Reference applicable UL standard referenced)
B. Efficiencies indicated in this section are based on ASHRAE Standard 52.
C. Fan motors have been selected to operate against the resistance of dirty filters as specified in this section.

1.08 OPERATION AND MAINTENANCE DATA
A. All operations and maintenance data shall comply with the submission and content requirements specified in Section 23 05 00 – Common Work Results for HVAC.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. American Air Filter, Barnebey-Cheney, Cambridge, Continental, Flanders, Camil-Farr, Mine Safety Appliances, Research Products, BLC Industries.
B. Provide fixed filter blockoffs as required to prevent air bypass around filters. Blockoffs shall not need to be removed during filter replacement.

2.02 PANEL FILTERS

A. Use 1" (or as scheduled) thick fiberglass blanket enclosed in a cardboard frame and reinforced with a perforated metal retainer on the air leaving side, Coat media with flameproof, non- volatile adhesive.
B. Media nominal rating to be 500 FPM face velocity, 0.15 inch WG initial resistance, 0.50 inches WG recommended final resistance. Average arrestance of filter media shall be 80%.
C. Provide filter holding frame.

2.03 HOUSINGS FOR PANEL FILTERS

A. Manufactured by air handling unit manufacturer, filter media manufacturer, or contractor fabricated. Casing and tracks constructed of galvanized or enameled steel or aluminum. Provide access to the media tracks from outside the casing so media and be readily changed.

2.04 HOUSINGS FOR MERV 7 FILTERS

A. Housing or holding frame to be of the same manufacturer as filter media or provided by the air handling unit manufacturer. Contractor fabricated housings or filter racks will not be accepted. Casing and tracks constructed of galvanized or enameled steel or aluminum. Provide access to the media tracks from outside the casing so media and be readily changed. Filter tracks shall be constructed to provide a minimum clearance of 2 inches between the pre-filter and final-filter media to facilitate the installation of static pressure tips.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Where air handling equipment is to be used for temporary heating or ventilation of a facility, do not operate the equipment until specified filter media has been installed. Contractor shall be responsible for maintaining the cleanliness of air handling apparatus and air distribution systems during construction through regular inspection and changing of filter media throughout the construction period.
B. Where air handling apparatus is used during the construction period, install new filter media prior to start of air balancing. Additionally, deliver one new set of media to the owner prior to substantial completion.
C. Install units as shown on drawings and details according to manufacturer's instructions.
D. Reinforce filter holding frames per manufacturer's instructions.
E. Maintain necessary clearance for changing filters.

3.02 TRAINING

A. See Section 23 05 00 – Common Work Results for HVAC for general training requirements.

END OF SECTION

SECTION 23 52 00
HEATING BOILERS

PART 1 - GENERAL

1.01 SCOPE OF WORK
A. Unless noted otherwise, the Contractor shall provide all labor and materials for a complete system in this specification section.

1.02 SECTION INCLUDES
A. This section includes specifications for hot water and steam heating equipment. Included are the following topics:
   1. Sealed Combustion Boiler, Condensing, Hi-Efficiency, Modular
   2. Emergency Shutdown Switch

1.03 RELATED WORK
A. Applicable provisions of Division 1 govern work under this section.
B. Section 23 05 00 – Common Work Results for HVAC
C. Section 23 05 23 – General Duty Valves for HVAC Piping
D. Section 23 09 93 – Sequence of Operations for HVAC Controls
E. Section 23 21 13 – Hydronic Piping
F. Section 26 29 00 – Low Voltage Controllers

1.04 SUBMITTALS
A. Refer to Section 23 05 00 – Common Work Results for HVAC, Submittals. In addition to the general content specified under Section 23 05 00 – Common Work Results for HVAC, supply the following submittals:
   1. Sealed Combustion Boiler, Condensing, Hi-Efficiency, Modular
   2. Emergency Shutdown Switch
B. Include data concerning dimensions, capacities, and material of construction, ratings, weights, manufacturer's installation requirements and performance limitations.
C. Submit manufacturer's installation instructions including required clearance to combustible materials.

1.05 REFERENCE STANDARDS
A. ASME CSD-1 Control and Safety Devices for Automatically Fired Boilers
B. ASME Boiler and Pressure Vessel Code I - Rules of Construction of Power Boilers
C. ASME Boiler and Pressure Vessel Code VIII - Rules for Construction of Pressure Vessels
D. ASME Boiler and Pressure Vessel Code IX - Welding and Brazing Qualifications
E. ASME Boiler and Pressure Vessel Code I V - Rules for Construction of Heating Boilers
F. UL 795 Commercial Industrial Gas Heating Equipment
G. NFPA 70 Electrical Wiring and Devices
H. National Electric Code

1.06 QUALITY ASSURANCE
A. Refer to Division 1 for equals and substitutions

1.07 WARRANTY
A. 5-year Boiler pressure vessel warranty against leakage due to defective workmanship. 1 - year period heat exchanger tubes/combustion chamber assembly warranty against failure due to thermal stress or failure of condensate corrosion. All other boiler, burner and control parts warranted for one year from startup.
B. Sealed combustion boiler, condensing, hi-efficiency, modular helical heat exchanger/combustion chamber design that will be self-supporting and warranted for a period of 5 years to withstand thermal shock. Heat exchanger shall be warranted against leakage for a period of 5 years.

1.08 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified in Section 23 05 00 – Common Work Results for HVAC.

1.09 ENERGY EFFICIENCY

A. All boilers with a capacity of less than 300,000 btu/hr. input must be labeled as Energy Star by its manufacturer.
B. All boilers with a capacity of 300,000 btu/hr. input must meet the efficiencies specified. Minimum boiler efficiencies are based on Federal Energy Management Program (FEMP) recommendations.

1.10 REGISTRATION

A. Complete Boiler and Unfired Pressure Vessel (UPV) Installation Registration and forward to the Department of Safety and Professional Services in accordance with the Wisconsin Administrative Code Chapter SPS 341.24.

PART 2 - PRODUCTS

2.01 SEALED COMBUSTION BOILER, CONDENSING, HI-EFFICIENCY, MODULAR

A. Manufacturers: Lochinvar (Knight), Camus, Fulton, Aerco. Weben-Jarco, Thermal Solutions, Cleaver-Brooks.
B. Provide units with capacity and operating characteristics indicated on schedules.
C. Boiler ASME stamped for 160 psig and designed per ASME section IV. Furnish a relief valve in compliance with ASME section IV and set at 30 psig. All internal combustion chamber, and internal burner components, shall be manufactured with materials suitable to withstand constant operation under condensing conditions. Combustion chamber shall have a condensate drain to discharge any condensate buildup.
D. Boiler efficiency 90%+ per ANSI Z21.13a and operation in the condensing mode with inlet temperatures as low as 90 F.
E. Combustion air intake capable of accepting either free mechanical room air, or direct outside air through a sealed intake pipe of the length and diameter shown on drawings. Provide inlet/outlet combustion vent temperature fittings with direct outside air application
F. Category IV flue vent connection, condensing positive pressure for both horizontal and sidewall venting. The vent outlet shall be compatible with, and used only with, type AL29-4C vent material.
G. Baked enamel finish boiler sheet metal jacket with removal panels for maintenance access.
H. Inlet and outlet temperature gauge to monitor inlet and outlet water temperatures.
I. Provide a water temperature controller.
J. Unit shall be manufactured to operate water temperatures between 32 degrees Fahrenheit to 194 degrees Fahrenheit
K. Provide each boiler with a low water cutout operationally testable, manually reset on loss of low-water and auto-rest on loss of power in accordance with ASME Section IV and CSD-1.
L. Provide each boiler with dual over temperature protection, including manual reset, in accordance with ASME Section IV and CSD-1.
M. Provide remote fault alarm contact for flame sensor and high temperature limit failure.
N. Provide single point wiring for controls and fan.
O. Natural gas-fired modulating burners, forced draft power type, with a positive pressure at the boiler discharge. Stainless steel burner mixer. Maximum Nox emissions under 20 PPM.
P. Furnish units with fuel trains and operating controls conforming to the latest UL or equivalent agency approval, CSD-1 requirements and Boiler/burner package shall be factory assembled, wired, mounted, and factory fire tested.

Q. Provide a multiple boiler sequencing panel (BMS) capable of staging boilers to maintain peak seasonal efficiency. BMS shall include a sensor to monitor main loop system temperature, and a sensor to monitor outside air temperature. BMS shall be capable of outdoor reset, loop temperature span, and set loop temperature. BMS shall have the capability to stage boilers based on loop temperature and outdoor reset for highest operating seasonal efficiencies. BMS shall be capable of starting and stopping the system based on a remote contact closure and have the ability to change setpoint from a remote location. Monitor status of boilers with BMS. Manufacturers: Honeywell, Heat Timer, Techmar.

2.02 EMERGENCY SHUTDOWN SWITCH

A. Provide a manually operated remote shutdown switch or circuit breaker for each boiler. Locate the switch just outside the boiler room door. Mark the emergency shutdown switch for easy identification. If the boiler room door is on the building exterior, the switch should be located just inside the door. If there is more than one door to the boiler room, provide a switch at each door.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install units as shown on plans, as detailed, and according to manufacturer's installation instructions.
B. Set units on concrete housekeeping pads.
C. Install all items shipped loose by equipment manufacturer under supervision of equipment manufacturer's field service personnel.

3.02 BOILERS

A. After piping system has been flushed, boil out boilers using chemical and procedure as recommended by boiler manufacturer. Perform boil-out under supervision of boiler manufacturer's representative.
B. Manufacturer shall verify in writing that boilers have been cleaned according to their recommendations and are ready for operation.
C. Isolate boilers from piping system during boil-out.
D. Pipe vents from gas train to atmosphere. Size of each vent shall not be less than connection size to device.
E. Pipe boiler drains to nearest floor drains or floor trench.
F. Owner's representative and/or Engineer will observe boil-out. Contractor must notify Owner/Engineer at least 72 hours prior to boil-out.
G. Install gas pressure gauges at downstream of gas pressure regulators.
H. If remote control panels are used, install all interconnecting wiring and pneumatic tubing if used between panels and units.

3.03 TRAINING

A. See Section 23 05 00 – Common Work Results for HVAC for general training requirements.
B. In addition to the training provided in Section 23 05 00 – Common Work Results for HVAC, provide an additional **4 hours** of training for each type of boiler provided on the project.
C. Provide manufacture's recommended start-up procedures and documentation to indicate the equipment has been installed and operates per the manufacturers requirements. This documentation is to include measurements associated with system performance such as input power, output power, flue gas readings, kW/ton, inlet temperatures and outlet temperatures as needed to indicate the equipment operation meets the manufacturers documented performance.

END OF SECTION

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SECTION 23 74 13
ROOF TOP AIR-HANDLING UNITS

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Unless noted otherwise, the Contractor shall provide all labor and materials for a complete system in this specification section.

1.02 SECTION INCLUDES

A. This section includes specifications for roof top package air-handling units. Included are the following topics:
   1. Units 7-1/2 to 25 Tons

1.03 RELATED WORK

A. Applicable provisions of Division 1 govern work under this section.
B. Section 23 05 00 – Common Work Results for HVAC
C. Section 23 05 13 – Common Motor Requirements for HVAC Equipment
D. Section 23 05 14 – Variable Frequency Drives
E. Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment
F. Section 23 05 48 – Vibration and Seismic Controls for HVAC Piping and Equipment
G. Section 23 09 93 – Sequence of Operations for HVAC Controls
H. Section 23 11 00 – Facility Fuel Piping
I. Section 23 31 00 – HVAC Ducts and Casings
J. Section 23 33 00 – Air Duct Accessories
K. Section 23 34 00 – HVAC Fans
L. Section 23 41 00 – Particulate Air Filtration

1.04 SUBMITTALS

A. Refer to Section 23 05 00 – Common Work Results for HVAC, Submittals. In addition to the general content specified under Section 23 05 00 – Common Work Results for HVAC, supply the following submittals:
   1. Units 7-1/2 to 25 Tons
B. Submit shop drawings including the following information: specific manufacturer and model numbers, submittal equipment identification corresponding to project drawings and schedules, unit dimensional and weight data, materials of construction, capacities and ratings, fan curves, fan type, drive and motor information, vibration isolation, coil performance data, sound power levels, filter information, information for all accessories.

1.05 REFERENCE STANDARDS

A. ARI 430 (latest edition) Standard for Central Station Air Handling Units
B. ARI 210 Unitary Air-Conditioning Equipment.
C. ARI 240 Air Source Unitary Heat Pump Equipment.
D. ARI 270 Sound Rating of Outdoor Unitary Equipment.
E. NFPA 70 National Electrical Code.
F. NFPA 90A Standard for Installation of Air Conditioning and Ventilation Systems

1.06 QUALITY ASSURANCE

A. Refer to Division 1 for equals and substitutions.

1.07 DESIGN CRITERIA

A. Furnish factory fabricated roof top air handling units complete meeting the configuration shown on drawings and/or as scheduled.
B. Units to be tested, rated and certified in accordance with ARI Standard 430 and bear ARI certification label.
C. All material shall meet NFPA 90A flame spread and smoke develop rating requirements.
D. Any revisions made by the Contractor to the inlet and outlet ductwork conditions from that shown on the drawings shall not increase system effect and/or static pressure and shall not decrease mixing efficiencies.

1.08 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified in Section 23 05 00 – Common Work Results in HVAC.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Johnson Controls, Carrier, Daikin, Trane, York and Aaon Inc.

2.02 7-1/2 TO 25 TON UNITS

A. General:
   1. The units shall be dedicated downflow or horizontal airflow. Refrigerant shall be R410A. Performance shall be certified in accordance with ARI Standard 210 and 270, American Gas Association, and UL listed. All units shall be factory assembled, internally wired, fully charged with refrigerant and 100 percent run tested to check cooling operation, fan and blower rotation and control sequence, before leaving the factory. Wiring internal to the unit shall be colored and numbered for simplified identification. Units shall be UL listed and labeled with the following information:
      a. Refrigerant
      b. EER
      c. AFUE
B. Casing/Cabinet:
   1. Unit shall be constructed of 18 gauge, G90 galvanized steel with powder coat or baked enamel finish. Unit's finish shall be tested 500 hours minimum in a salt spray test in compliance with ASTM B117. Casing shall be insulated with a minimum of ¾" foil faced fiberglass. Insulation shall be mechanically fastened to the unit. Double wall construction may be used as a substitution.
   2. Wall/Roof panel deflection shall not exceed L/240 ratio at a maximum +/- 5 inches of static pressure. Deflection shall be measured at the midpoint of the panel.
   3. Base frame shall be constructed of 16 gauge minimum G90 galvanized steel and shall have integral lifting and rigging holes for installation. Base shall overhang roof curb to provide for positive water runoff and weather tight seal.
   4. Duct openings in base shall be provided with 1" flange to prevent any water getting into duct system.
   5. All access panels shall have gaskets and be provided with fasteners and handles. Panels shall be insulated to match unit construction.
   6. Duct sealant and/or gaskets as indicated in Section 23 31 00 – HVAC Ducts and Casings may be utilized to seal duct connections to the roof top air handling unit casing. Silicone sealants are not acceptable. Unit leakage rate shall not exceed 1% of the total system air quantity when subjected to +/- 5" static pressure.
C. Fans:
   1. Supply fan wheels shall be backward inclined, forward curved or airfoil type as specified or required by performance characteristics.
   2. Each fan and motor combination shall be capable of delivering 110% of air quantity scheduled at scheduled static pressure. The motor furnished with the fan shall not operate into the motor service factor when operating under these conditions.

3. Fans to be fastened to hollow or solid steel shafts and designed for continuous operation at maximum rated static pressure. All fan assemblies shall be statically and dynamically balanced at the factory, including a final trim balance, prior to shipment. Bearings shall be sized to provide a L-50 life of 250,000 hours.
4. Furnish variable pitch sheaves for drives 3 hp and smaller, fixed pitch sheaves for drives 5 hp and larger. Drives shall be designed for 150% of motor rating. Furnish OSHA approved belt guards for all fans.
5. Condenser fans shall be direct drive, axial type designed for low tip speed and vertical air discharge. Fan blades shall be constructed of steel and riveted to a steel center hub. Condenser fan motors shall be heavy-duty, non-reversing type with permanently lubricated ball bearing and thermal protection. Motor design shall be totally enclosed air over (TEAO) to protect the motors from rain and damage by water.
6. Optional Power relief fans shall be direct drive, centrifugal or axial type designed for horizontal air discharge. Fan motors shall be heavy-duty, non-reversing type with permanently lubricated ball bearing and thermal protection. Motor design shall be totally enclosed air over (TEAO) to protect the motors from rain and damage by water.
7. Fan motors shall be provided in accordance with section 23 05 13 – Common Motor Requirements for HVAC Equipment.

D. Heating (Gas):
1. Gas-fired heating section shall provide completely assembled, wired, and piped gas-fired heating system within unit. Design certified AGA specifically for outdoor application.
2. Burner shall be capable of providing a modulating firing rate.
3. Heat exchanger shall be embossed, formed, and seamed 18 gauge stainless steel, factory tested for gas leaks, stress relieved, free floating design.
4. Burners shall be stamped and seam-welded 20 gauge stainless steel.
5. Provide induced draft combustion blower to ensure flame stability under varying wind conditions and to give high combustion efficiency.
6. Provide induced draft type burner, pressure regulator, gas valves, manual shut-off, intermittent spark or hot surface ignition, flame sensing device, and automatic 100 percent shut-off pilot.
7. Provide gas burner safety controls to energize ignition, limit time for establishment of flame, prevent opening of gas valve until pilot flame is proven, stop gas flow on ignition failure, energize blower motor, and after air flow proven and slight delay, allow gas valve to open.
8. Provide high limit control to de-energize burner on excessive bonnet temperature and energize burner when temperature drops to lower safe value.

E. Cooling:
1. Provide a minimum of two steps of cooling capacity with independent refrigeration circuits.
2. Provide low ambient control to allow mechanical cooling to operate down to 0 degrees F.
3. Provide unit with a minimum EER per drawings. If EER is not indicated on drawings, the minimum EER shall be equal to or greater than the 2015 International Energy Conservation Code].

F. Compressors:
1. All units shall have direct-drive, hermetic, scroll type compressors with centrifugal type oil pumps.
2. Motor shall be suction gas-cooled and shall have Internal overloads shall be provided with the scroll compressors. All models shall have crankcase heaters, phase monitors and low and high pressure control as standard.
3. Provide a time delay between starting of first and second compressor with multiple compressor units.
4. A lockout timer shall provide a minimum off time of five minutes between compressor cycling.

G. Coils:
1. Condenser coils shall be multi-row and fabricated from high efficiency copper tubing mechanically bonded to high efficiency aluminum fins. Each condenser coil shall be factory leak tested to 150 psig, pressure tested to 650 psig, and qualified to UL 1995 burst test at 1980 psig. Provide hail guards to protected coils.

2. Evaporator coils shall be multi-row and fabricated from high efficiency copper tubing mechanically bonded to high efficiency aluminum fins. Each coil shall have interlaced coil circuiting. Each evaporator coil shall be factory leak tested to 150 psig, pressure tested to 450 psig, and qualified to UL 1995 burst test at 1775 psig.
3. Fabricate cooling coil drain pans from type 304 stainless steel. Install a drain pan under each cooling coil. Extend drain pans the entire width of each coil, including the header, and from the upstream face of each coil to a distance ½ of the vertical coil height of the bottom coil or 6", whichever is greater, downstream from the downstream face. Pitch drain pans in two directions towards the outlet. Pipe drain pans individually down to the drain pan below using a minimum 1" type 304 stainless steel piping. The bottom drain pan shall be piped to the exterior of the unit base.

H. Economizer:
1. Provide economizer controls per schedule with dehumidification controls.

I. Electrical:
1. Provide unit mounted disconnect for a single point power connection.
2. Provide unit mounted GFI convenience outlet. Outlet shall be powered from unit. Outlet shall be provided with a separate power circuit.

J. Filters:
1. Unit shall be provided with a draw-through filter section. The filter rack shall be designed to accept a 2" filter. The unit design shall have a hinged access door for the filter section. See Section 23 41 00 – Particulate Air Filtration for filter information.

K. Roof Curb:
1. Provide 18" high insulated roof curb with vibration isolation.
2. See Sections 23 05 29 – Hangers and Support for HVAC Piping and Equipment and 23 05 48 – Vibration and Seismic Controls for HVAC Piping and Equipment for additional information.

L. Controls:
1. Provide complete DDC controls to operate the RTU. Controls shall be BacNet (MS/TP and/or PTP modes) compliant and capable of interfacing with an existing DDC system.
2. DDC control shall accept the following inputs: space temperature, setpoint adjustment, outdoor air temperature, compressor lock-out, fire shutdown, enthalpy switch, and fan status / filter status / humidity / remote occupancy.
3. DDC control shall provide the following outputs: economizer enable, fan enable, cooling stage 1 on, cooling stage 2 on, heat stage 1on, heat stage 2 on.
4. Refer to Section 23 09 93 - Sequence of Operations for HVAC Controls for Control of discharge temperature, space temperature and fan speed.

M. Warranty:
1. Provide a 1 year warranty on unit parts, 5 year warranty on compressors, and 10 year warranty on heat exchanger.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install all roof top air handling units and accessories as indicated on drawings and/or as scheduled and according to manufacturer's installation instructions.
B. Mount units at appropriate height above roof to insure proper condensate trap depth and condensate drainage.
C. Install roof top air handling unit to provide for adequate service access. Coordinate with other trades to assure unit does not infringe upon access or service clearances of other equipment.
D. Lubricate fan bearings. Verify fan isolators have proper deflection and curb mounted spring rail has been installed properly.

E. Upon completion of installation of roof top air handling units, start-up and operate equipment to demonstrate capability and compliance with requirements. Field correct malfunctioning components, then retest to demonstrate compliance.

3.02 TRAINING

A. See Section 23 05 00 – Common Work Results for HVAC for general training requirements.
B. In addition to the training provided in Section 23 05 00 – Common Work Results for HVAC, provide an additional 4 hours of training on the project.

END OF SECTION

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SECTION 23 82 00
HEATING AND COOLING TERMINAL UNITS

PART 1 – GENERAL

1.01 SCOPE OF WORK
A. Unless noted otherwise, the Contractor shall provide all labor and materials for a complete system in this specification section.

1.02 SECTION INCLUDES
A. This section includes specification for heating and cooling terminal equipment using water and/or steam as the source. Included are the following topics:
   1. Reheat Coils
   2. Unit Heaters
   3. Cabinet Heaters
   4. Convectors
   5. Fin Tube Radiation

1.03 RELATED WORK
A. Applicable provisions of Division 1 govern work under this Section.
B. Section 23 05 00 – Common Work Results for HVAC
C. Section 23 05 13 – Common Motor Requirements for HVAC Equipment
D. Section 23 05 23 – General Duty Valves for HVAC Piping
E. Section 23 09 93 – Sequence of Operations for HVAC Controls
F. Section 23 33 00 – Air Duct Accessories
G. Section 23 41 00 – Particulate Air Filtration

1.04 SUBMITTALS
A. Refer to Section 23 05 00 – Common Work Results for HVAC. In addition to the general content specified under Section 23 05 00 – Common Work Results for HVAC, supply the following submittals:
   1. Reheat Coils
   2. Unit Heaters
   3. Cabinet Heaters
   4. Convectors
   5. Fin Tube Radiation
B. Include dimensions, capacities, materials of construction, ratings, weights, wiring diagrams, and appropriate identification for all equipment in this section. Include color selection chart where applicable.

1.05 REFERENCE STANDARDS
A. ARI 210 Standard for Unitary Air-Conditioning Equipment
B. ARI 410 Standard for Forced-Circulation Air-Cooling and Air-Heating Coils
C. CS 140

1.06 QUALITY ASSURANCE
A. Refer to Division 1 for equals and substitutions

1.07 DESIGN CRITERIA
A. Forced Circulation Coils: Ratings certified in accordance with ARI 410.
B. Electrical Equipment and heaters shall be UL listed for the service specified.
C. Electrical components and work must be in accordance with National Electrical Code.

1.08 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified in Section 23 05 00 – Common Work Results for HVAC.

PART 2 – PRODUCTS

2.01 REHEAT COILS

A. Manufacturers: Carrier, Trane, McQuay, Marlo.
B. Construct coils of copper tubes and aluminum fins in a serpentine arrangement with piping connections on the same end. Provide galvanized steel casing, end supports, top and bottom channels to allowance for expansion of finned tube section. Factory test coils at 200 psig.
C. Headers may be cast iron with tubes expanded into the header, steel pipe with tubes brazed to the header, or seamless copper with tubes brazed to the header.
D. Frames to be flanged for a gasketed connection to adjacent ductwork or constructed for slip and drive connection to the ductwork.
E. Minimum reheat coil size is 8 inches x 8 inches.

2.02 UNIT HEATERS

A. Manufacturers: Modine, McQuay, Trane, Airtherm.
B. Construct casing of 18 gauge steel with baked enamel finish and heating elements of copper tubing with aluminum fins. Use aluminum fan blades, balanced for quiet operation. Provide safety guard for fan/drive assembly. Test coils units at 200 psig.
C. Furnish adjustable horizontal and vertical discharge louvers for units with horizontal discharge. Provide an adjustable cone diffuser for projection units with vertical discharge.
D. Furnish motors with characteristics as scheduled. Single phase, 120 volt motors to be permanently lubricated and provided with thermal overload protection.

2.03 CABINET HEATERS

A. Manufacturers: American Air Filter, Sterling, McQuay, Trane, Airtherm.
B. Construct vertical unit casings with 16 gauge steel front panels and minimum 18 gauge steel end and side panels. Horizontal units located in concealed spaces or mounted in ceiling to have minimum 18 gauge front, end, and side panels.
C. Furnish exposed cabinets in a baked enamel finish in colors selected by the Architect or Owner.
D. Furnish ceiling mounted units with a hinged front panel to allow access to all internal components.
E. Construct heating elements of copper tubes with aluminum fins, tested at 200 psig.
F. Use centrifugal type fans, statically and dynamically balanced to operate without objectionable noise and vibration.
G. Motors to be 120 volt, single phase, permanently lubricated, with thermal overload protection and disconnect switch at unit.
H. Furnish each unit with filter rack and 1" panel filters as specified in Section 23 41 00 – Particulate Air Filtration.

2.04 CONVECTORS

A. Manufacturers: Modine, Sterling, Trane, Airtherm.
B. Construct heating elements of copper tubes with aluminum fins expanded into cast iron or brass headers. Support heating elements on adjustable brackets to allow for expansion and pitch. Certify coil ratings in accordance with Commercial Standard CS 140.
C. Construct enclosures of 18 gauge steel back and end panels, and 16 gauge steel front and top panels. Furnish in a baked enamel finish in one of the manufacturers' standard colors, selected by Architect.

2.05 FIN TUBE RADIATION

A. Manufacturers: Slant/Fin, Sterling, Trane, Vulcan, Rittling.
B. Construct heating elements of steel fin on steel tube or aluminum fin on copper tube. Provide wall mounted support cradles which allow expansion of heating element without noise.

C. Enclosures: Sloped top with die formed grilles. Constructed with removable front panels of 16 gauge steel, 20 gauge steel back panels, and furnished with a baked enamel finish in colors selected by Architect or Owner.
D. Provide dirt gasket for mounting between back panel and wall.
E. Provide accessories such as inside and outside corners and end caps where required for the complete installation. Where wall-to-wall installations are indicated on plans, provide enclosure extensions or field modification of enclosure to conform to actual room dimensions.
F. Provide hinged access doors at all valves, traps, and vents.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install units in accordance with manufacturer's installation instructions.
B. Install branch water or steam/condensate piping to each unit with a minimum of three elbows to allow for expansion and contraction of the piping system.
C. Coordinate location of units with other trades to assure correct recess size for recessed units.
D. After installation, provide protective covers to prevent accumulation of dirt on units during balance of construction.

3.02 REHEAT COILS

A. Comb bent or crushed fins and clean dust and debris from each coil before enclosing coils in ductwork. Pitch coil casings in accordance with manufacturer's instructions. Install a drain valve on the coil side of the shutoff valves for each reheat coil.
B. Pipe coils with multiple rows for counter flow arrangement.

3.03 UNIT HEATERS

A. Suspend units from building structure and as high as possible to maintain headroom beneath units; supporting from piping systems will not be accepted.
B. Install a drain valve on the coil side of the shutoff valves for each hot water unit heater.

3.04 CABINET HEATERS

A. Mount units in locations indicated on the drawings and as detailed. Install a drain valve on the coil side of the shutoff valves for each hot water cabinet heater.

3.05 CONVECTORS

A. Mount units in locations indicated on the drawings and as detailed. Install a drain valve on the coil side of the shutoff valves for each hot water cabinet heater.

3.06 FIN TUBE RADIATION

A. Install dirt guard gasket to mounting strip or caulk along top of mounting strip.
B. Install a drain valve on the radiation side of the shutoff valves for each separately valved section of radiation.
C. Install access doors or panels, centered in front of each shut-off valve, balancing valve, steam trap, and temperature control valve located inside radiation enclosure.

3.07 TRAINING

A. See Section 23 05 00 – Common Work Results for HVAC for general training requirements.
B. In addition to the training provided in Section 23 05 00 – Common Work Results for HVAC, provide an additional 1 hours of training for each type of heating and cooling terminal unit provided on the project.

END OF SECTION

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SECTION 27 05 00
COMMON WORK RESULTS FOR COMMUNICATIONS SYSTEMS

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Base Bid: It is the intent of these specifications to provide complete and workable telecommunications systems – including all parts lists, operating instructions and wiring diagrams, as shown on the accompanying plans and as specified herein except such parts as are specifically exempted herein. Provide all necessary supervision, coordination, labor, materials, equipment, fixtures, drayage, hoisting, tools, transportation, plant services and facilities, machinery and connections to utilities for the installation of complete and operable telecommunications systems. If details or special conditions are required in addition to those shown on drawings, provide all material and equipment usually furnished with such systems or required to complete their installation, whether noted in plans and specification or not.

B. Materials and labor shall be new (unless noted otherwise), first class and workmanlike and shall be subject at all times to the A/E's inspections, tests and approval from the commencement until the acceptance of the completed work.

C. The layout shown on the drawings is necessarily diagrammatic but shall be followed as closely as other work will permit. The drawings provide design intent. The Contractor shall verify all dimensions at the site and be responsible for their accuracy.

D. Because of the scale of the Drawings, certain basic items, such as, pipe fittings, duct fittings, access panels, and sleeves, may not be shown. Where such items are required by Code or by other Sections, or where required for proper installation of the Work, such items shall be included, whether shown or not.

E. In the event of any inconsistencies between the specifications, drawings, contract documents, applicable laws, statutes, ordinances, building codes, rules and regulations, the contractor shall provide the better quality or greater quantity of work and comply with or conform its work to the most stringent legal or contractual requirements.

F. Changes from these drawings required to make this work conform to the building construction shall be made only with prior written approval of the Architect/Engineer. All proposed changes shall be shown on shop drawings. All measurements shall be verified by actual observation and all work shall fit in place meeting the approval of the Architect/Engineer.

G. CABLE RATINGS:
   1. The new addition will be ducted return allowing the use of non-plenum CMR cable.
   2. The existing historic building has return air plenums, requiring the use of CMP plenum cable.
   3. As long as separation is maintained, the contractor may elect to install cables of different ratings in segregated sections of the building. But where a cable passes from a CMR area to a CMP area, the higher CMP rating must be maintained for the entire cable.
   4. Where cables are solely underground and do not pass through a ceiling plenum, CM or CMR cable may be used.
   5. For simplicity, the contractor may elect to use all CMP plenum rated cable.

H. Equipment Specification may not deal individually with minute items required, such as, components, parts, controls, and devices which may be required to produce the equipment performance specified or as required to meet the equipment warranties. Where such items are required to make the system operational, they shall be included by the supplier of the equipment at no additional cost, whether or not specifically called for.

I. Equipment, materials and accessories for communications systems as shown and noted on the drawings including but not limited to the following:
   1. A complete raceway system including conduit, outlet box, pull boxes, junction boxes, sleeves and hangers. This work may be separated out for completion by the Division 26 contractor. Usually the General Prime Contractor (GPC) will assign this work to Div 26 contractor. Div 27 contractor shall confirm this arrangement prior to bidding.
   2. Complete structured cabling system including all riser and horizontal cables.

3. Communications distribution equipment including patch panels, innerduct, terminations, racks and cabinets.
4. Maintaining of all communications and other low voltage connections outside of or passing through the work area to other areas.
5. All cutting and patching to accomplish wiring tasks.
6. All conduit penetrations through walls and floors and complete fire stopping of penetrations per standards of a national testing laboratory.
7. Creation of new cable pathways through areas where no pathway currently exists.
8. New wiring devices, jacks and cover plates.

1.02 SECTION INCLUDES

A. This section includes information common to two or more technical communications specification sections or items that are of a general nature, not conveniently fitting into other technical sections.
   1. Submittals
   2. Construction Verification Checklists
   3. Functional Performance Tests
   4. Reference Standards
   5. Quality Assurance
   6. Guarantee
   7. Work By Owner
   8. Equipment Furnished By Others
   9. Provisions For Future
   10. Operation And Maintenance Instructions
   11. Record Documents
   12. Continuity Of Existing Services
   13. Protection Of Finished Surfaces
   14. Sealing And Firestopping
   15. Off Site Storage
   16. Regulatory Requirements
   17. Certificates And Inspections
   18. Coordination
   19. Request And Certification For Payment
   20. Sleeves And Openings
   21. Omissions
   22. Definitions
   23. Project/Site Conditions
   24. Work Sequence And Scheduling
   25. Salvage Materials
   26. Performance Testing
   27. Description
   28. Dimensions And Define Locations
   29. Training
   30. Access Panels And Doors
   31. Identification
   32. Demolition
   33. Cutting And Patching
   34. Building Access
   35. Equipment Access
   36. Housekeeping And Clean Up
   37. Cable Installation
   38. Testing
   39. Systems Checklist

1.03 RELATED WORK

A. Applicable provisions of Division 1 govern work under this section.

B. This section is applies to all Division 27 sections.
C. Section 27 05 26 – Grounding and Bonding for Communications Systems
D. Section 27 05 53 – Identification for Communications Systems
E. Section 27 05 60 – Communications Firestopping
F. Section 27 11 00 – Communications Room Provisioning
G. Section 27 13 10 – Backbone Copper Cable and Equipment
H. Section 27 13 20 – Fiber Optic Cable and Equipment
I. Section 27 15 10 – Horizontal Copper Cable and Equipment
J. Section 27 40 00 – Audio-Visual Systems
K. Section 27 51 13 – Overhead Paging System
L. This work is also subject to all requirements of Division 26 of these specifications and NFPA 70 and the National Electric Code wherever applicable to work under this section.

1.04 SUBMITTALS

A. Submit shop drawings for equipment under each section per requirements listed in that section, as well as per Division 1.
B. Submit for all equipment and systems as indicated in the respective specification sections, marking each submittal with that specification section number. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in the contract documents. Failure to do this may result in the submittal(s) being returned to the Contractor for correction and resubmission. Do not submit hard copies of web pages. Failing to follow these instructions does not relieve the Contractor from the requirement of meeting the project schedule.
C. On request from the A/E, the successful bidder shall furnish additional drawings, illustrations, catalog data, performance characteristics, etc.
D. Submittals shall be grouped to include complete submittals of related systems, products, and accessories in a single submittal. Mark dimensions and values in units to match those specified. Include wiring diagrams of electrically powered equipment.
E. The submittals must be approved before fabrication is authorized.
F. Provide electronic copies of all submittals for review.

1.05 CONSTRUCTION VERIFICATION CHECKLISTS

A. Contractor is responsible for utilizing the construction verification checklists (if supplied) under these specifications in accordance with the procedures defined for construction verification checklists in Section 01 – Commissioning Requirements.

1.06 FUNCTIONAL PERFORMANCE TESTS

A. Contractor is responsible for utilizing the functional performance test procedures (if supplied) under these specifications in accordance with the procedures defined for functional performance test procedures in Section 01 – Commissioning Requirements.

1.07 REFERENCE STANDARDS

A. Abbreviations of standards organizations referenced in this and other sections are as follows:
   1. ANSI American National Standards Institute
   2. ASTM American Society for Testing and Materials
   3. BICSI Building Industry Consulting Service International
   4. EPA Environmental Protection Agency
   5. ETL Electrical Testing Laboratories, Inc.
   6. IEEE Institute of Electrical and Electronics Engineers
   7. IES Illuminating Engineering Society
   8. ISA Instrument Society of America
   9. NBS National Bureau of Standards
   10. NEC National Electric Code
   11. NEMA National Electrical Manufacturers Association
   12. NESC National Electrical Safety Code
   13. NFPA National Fire Protection Association

14. UL Underwriters Laboratories Inc.

1.08 QUALITY ASSURANCE

A. Substitution of Materials: Refer to Division 1 for equals and substitutions.
   1. Where the following conflicts with Division 1, the requirements of Division 1 shall govern.
   2. If the Contractor wishes to submit an alternate to the named manufacturers for any equipment, he may submit a voluntary alternative minimum 7 days prior to bid, stating the manufacturer's name, model number, written, detailed product data.
   3. Where materials or equipment are specified by name the proposed material or equipment must be identical to the specified material or equipment in all characteristics of quality, function and serviceability, regardless of application in the Project and, in addition, when the Architect deems that aesthetic significance is important, the equal material or equipment must be identical in all characteristics of visual appearance, design, color and texture. Any proposed equal shall be submitted to Architect/Engineer for prior approval, which Architect/Engineer may approve or disapprove in its sole discretion. Work performed or constructed with unapproved equals is at Contractor's risk and any required correction of work incorporating unapproved equals shall be at Contractor's sole cost and expense.
   4. In all instances, Contractor shall assume full responsibility for proof of equality of the statute to the equipment hereinafter specified. All data and information necessary for proof of equality, function and space requirements shall be prepared and accompany the submittal of the substitution to the Architect/Engineer. Approval by the Architect/Engineer of equipment other than the specified does NOT relieve Contractor of this responsibility.
B. All products and materials used are to be new, undamaged, clean and in good condition. Existing products and materials are not to be reused unless specifically indicated.
C. Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings, or engineering parameters from those indicated on the contract documents, the contractor is responsible for all costs involved in integrating the equipment or accessories into the system, including, but not limited to, coordination with other trades and any required changes by other trades and for obtaining the intended performance from the system into which these items are placed.
D. General:
   1. Cable and Equipment Manufacturer(s) shall be a company specializing in communications cable, accessories and/or equipment with minimum of 5 years documented experience in producing cable, accessories and/or equipment similar to those specified herein.
E. Contractor Qualifications:
   1. Qualified personnel utilizing state-of-the-art equipment and techniques shall complete all cable and equipment installation and termination.
   2. Contractor shall have been in this business for minimum of 5 years and completed 4 projects of magnitude specified in the following sections.
   3. Contractor shall be certified by the cabling/connectivity manufacturer to install the products provided.
   4. See Appendix A for complete qualifications.
F. Cable Systems:
   1. Cable and connection hardware (fiber optic and copper) shall be qualified by Contractor and Manufacturer(s) as certified cabling system. Refer to manufacturers' recommendations for appropriate component types. Contractor shall install and test cable to meet all performance criteria and complete all documentation required by manufacturer in order to obtain cabling system warranty (performance warranty certification). Contractor shall obtain warranty from manufacturer within 30 days of substantial completion and provide a copy of approved warranty to the engineer, the original to the owner.
   2. Provide as-built jack label documentation indicating actual locations and labels of all station jacks, changes in cable schedules and changes in rack mounted equipment. See specifications for other labeling requirements.

1.09 GUARANTEE

A. Refer to Division 1 for Guarantees and Warranties. In addition to the requirements in Division 1, this Contractor shall meet the following requirements.
B. In entering into a contract covering this work, the contractor accepts the specifications and guarantees that the work will be carried out in accordance with the requirements of this specification or such modifications as may be made under the contract documents.
C. Contractor further guarantees that the workmanship and material will be of the best procurable and that none but experienced workmen familiar with each particular class of work will be employed.

D. Contractor further guarantees to replace and make good at his own expense, including travel time, all defects, which may develop within 1 year after final payment and acceptance by the Architect/Engineer, due to faulty workmanship or material, upon, receipt of written notification from the Owner.
E. Manufacturer(s) of cabling and connectivity system shall warranty materials, equipment, and performance etc. for minimum of 20 years from date of substantial completion of work. Warranty shall include labor, material and travel time.

1.10 WORK BY OWNER

A. Owner will provide active electronics for interface with building voice and data cabling systems.
B. Owner will provide connections (service activation) from telephone and data equipment to Contractor provided cabling and equipment and cross connects from Backbone Voice Cables to Voice Station Cables.
C. Devices for OFOI systems may be shown on plans for information only and for provision of back boxes, conduits, raceways and general coordination.

1.11 EQUIPMENT FURNISHED BY OTHERS

A. Library System to provide network equipment, telephones, PCs and .

1.12 PROVISIONS FOR FUTURE

A. AV system base design will allow use of future 4K displays and projectors.
B. Conduit should be provided by Div 26 from wall outlet up to accessible ceiling for future cable changes.

1.13 OPERATION AND MAINTENANCE INSTRUCTIONS

A. Refer to Division 1 for all operations and maintenance instructions.
B. In addition to the general content specified under Division 1 supply the following additional documentation:
   1. Copies of all approved submittals along with approval letters
   2. Certificates
   3. Warranties
   4. Operation manual documents to assist the Owner to maintain all systems
   5. Records of test performed to certify compliance with system and manufacturer requirements
   6. Full equipment cut sheets including brands, makes, models, supplier (retailer) and manufacturer information (name, phone, e-mail, website, contact name), one-line diagrams, cable connections, system architecture
   7. Contractor information (name, phone, e-mail, website, contact name)
   8. Systems checklist (refer to Part 3 below)

1.14 RECORD DOCUMENTS

A. Refer to Division 1 for record documents.
B. In addition to the general content specified under Division, follow the following procedures.
   1. During the progress of the work, Contractor shall maintain a current (daily) record set of the drawings and specifications, indicating thereon all work installed at variance with such Contract Documents including, without limitation, work covered by Addenda, Field Work Orders, Change Orders and Engineers additional instructions, interpretations and clarification. All changes or deviations from the original layout of the work and all critical dimensions of buried or concealed

work shall be recorded. It shall be Contractor's responsibility to assure that said record sets are complete, accurate and up-to-date, Engineer shall have the right to inspect and review such record sets.

2. At the completion of the work, Contractor shall indicate on record sets all record changes and such additional details necessary or appropriate to provide a complete reference document for use by Engineer. If variations and details cannot be shown clearly thereon, the Contractor shall prepare supplemental drawings adequate to impart the information. The foregoing drawings collectively shall constitute the "Record" drawings for the work.
3. All indication on "Record" drawings shall be executed in a legible manner at Contractor's cost, using methods and legend presentations compatible with the overall scheme of the record drawings with respect to scale, drawing sheet sizes and sequential indexing. All changes shall be marked clearly in red and clouded.
4. Engineer may review Contractor's "Record" drawings and notify Contractor of observed discrepancies or deviations. Contractor shall promptly correct discrepancies, deviations or illegible markups at Contractor's expense and resubmit revised drawings for Engineer review.
5. Contractor shall provide final electronic record drawings to the Owner through the Engineer.
6. Engineer will provide final electronic record drawings to the Owner based on Contractor's markups.

1.15 CONTINUITY OF EXISTING SERVICES

A. Do not interrupt or change existing services without prior written approval from the Owner's Project Representative. When interruption is required, coordinate scheduling of down-time with the Owner to minimize disruption to his activities. Unless specifically stated, all work involved in interrupting or changing existing services is to be done during normal working hours.

B. Each Contractor shall thoroughly familiarize himself with existing systems which will affect and be affected by relocation of existing equipment and installation of new lines and equipment. They shall plan installation of their work so that interruptions of services to any building or portion thereof will be a minimum and such interruptions shall occur only when system is not required, if possible. If not possible, each Contractor shall insure the operation of services by whatever means possible, such as, installing bypasses, capping of services or providing temporary service. Each interruption shall be for as short a duration as possible.

C. No extra costs will be paid to the Contractor for such outages which must occur outside of regular weekly working hours.

D. This Contractor shall restore any circuit interruption as a result of this work to proper operation as soon as possible. Note that institutional operations are on a seven day week schedule.

1.16 PROTECTION OF FINISHED SURFACES

A. Refer to Division 1 for protection of finished services.

B. Furnish one can of touch-up paint for each different color factory finish furnished by the Contractor. Deliver touch-up paint with other "loose and detachable parts" per Division 1.

1.17 SEALING AND FIRESTOPPING

A. Sealing and firestopping of sleeves/openings between conduits, cable trays, wireways, troughs, cable bus, busduct, etc. and the structural or partition opening shall be the responsibility of the contractor whose work penetrates the opening. The contractor responsible shall hire individuals skilled in such work to do the sealing and firestopping. These individuals hired shall normally and routinely be employed in the sealing and fireproofing occupation.

B. Contractor shall request current life safety drawings from the Architect/Owner.

1.18 OFFSITE STORAGE

A. If payment will be requested for approved offsite stored material, then the Contractor shall complete an "Off-site Storage Agreement" which is available from the Owner. Prior approval by Owner's personnel for offsite storage will be needed. No material will be accepted for offsite storage unless submittals for the material have been approved.

1.19 REGULATORY REQUIREMENTS

A. Comply with requirements of Wisconsin Administrative Code and local Authority Having Jurisdiction (AHJ) regarding materials and installation.

1.20 CERTIFICATES AND INSPECTIONS

A. Refer to Division 1 for permits, regulations, utilities and taxes.
B. Obtain and pay for all required State or local installation inspections except those provided by the Architect/Engineer in accordance with State Code. Deliver originals of these certificates to the Owner. Include copies of the certificates in the Operating and Maintenance Instructions.
C. Coordinate and provide inspections as required by the Authority Having Jurisdiction over the site.

1.21 COORDINATION

A. Refer to Division 1 for coordination. In addition to the requirements specified under Division 1, the following requirements apply.
B. It shall be the responsibility of each Contractor to coordinate and consult with each other to determine space requirements and to determine that adequate space for servicing is provided for all equipment whether furnished by the Contractor or others. The General Contractor shall have final decision on all space priority conflicts among Contractors. All space priority conflicts shall be brought to the attention of the Architect/Engineer and Owner's Representative.
C. Each Contractor shall thoroughly familiarize himself with existing systems which will affect and be affected by relocation of existing equipment and installation of new lines and equipment. They shall plan installation of their work so that interruptions of services to any building or portion thereof will be a minimum, and such interruptions shall occur only when system is not required, if possible. If not possible, each Contractor shall insure the operation of services by whatever means possible, such as, installing bypasses, capping of services, or providing temporary service. Each interruption shall be for as short a duration as possible.
D. Cooperation among all Contractors shall be required. Any Work that is installed without cooperating or coordinating with other Contractors and is in conflict shall be removed and reinstalled at that particular Contractor's cost. No cost additions to the Project will be considered due to a Contractor's lack of participation in the cooperation and coordination process. The following list of items of Work shall be the priority of order for all Contractors:
   1. Structure
   2. Recessed light fixtures
   3. Gravity-flow systems for sanitary, storm, steam and steam condensate piping
   4. Ductwork and appurtenances
   5. Electrical and low voltage cable tray
   6. Plumbing vent piping
   7. Fire protection (sprinkler system)
   8. HVAC piping
   9. Medical gas piping
   10. Gas piping, process piping and domestic water
   11. Electrical conduit and low voltage conduit
   12. Control air lines or conduit
E. The above list, in descending order, is the precedence assigned the Work items for space priority. Gravity-flow systems have first priority.
F. Exception: Plumbing lines below or behind plumbing fixtures shall have precedence over all other work. Electrical conduit above or below switchgear, panelboards and control panels shall have precedence over all other work. Do not install any fluid conveying piping over electrical or elevator equipment.
G. In the case of interconnection of the work of two or more contractors, verify at the site or on shop drawings all dimensions relating to such work. All errors due to the failure to so verify any such dimensions shall be promptly rectified.
H. Any installed work that is not coordinated and interferes with another contractor’s work shall be removed or relocated at the installing contractor’s expense.
I. Prior to start of Construction, the General Contractor shall schedule a meeting with all of the Contractors responsible for the work items listed above. The purpose of the meeting is to introduce the coordination program and to determine its implementation in relation to the progress schedule.

J. At the initial Coordination Meeting, the Mechanical Contractor / Ventilating Contractor shall provide to the General Contractor outline drawings at 1/4" scale indicating column centerlines, interior partition locations, and ceiling heights. The General Contractor shall verify all information shown on these drawings and relay any changes in the information to the Ventilation Contractor to be reflected on the Drawings. The Ventilating Contractor, with reference and consideration to the Structural, Heating, Electrical, Fire Protection, and Plumbing Drawings, shall draw to scale his proposed installation showing duct sizes, equipment layouts, and dimensions from column lines and from finished floors to bottom of ducts. Ductwork shall be maintained as tightly as possible to the underside of floor slabs and/or beams. For congested areas the Ventilating Contractor shall, in addition, prepare Drawings in section view. During this phase of the program, it shall be the Electrical Contractor's responsibility to furnish the Ventilating Contractor with recessed lighting installation and clearance requirements. This information shall be outlined on the Drawings by the Ventilating Contractor.

K. The ductwork layouts shall be produced in sequence as mandated by the Project Schedule. The earliest area indicated in the Schedule shall receive the first effort, etc.

L. When the Ductwork Drawings for the earliest scheduled area have been completed (time limitation as determined at the initial coordination meeting), the Ventilating Contractor shall provide the General Contractor with one set of drawings for each participant in the effort. The General Contractor will distribute the drawings to the participating Contractors for their use in drawing thereon the major components of their proposed installation using the general scheme shown on the Contract Drawings as a guide.

M. The major components to be indicated include (but are not limited to) the following:
   1. Structure
   2. Roof drain leaders
   3. Above 3” waste piping
   4. Sprinkler mains
   5. Heating hot water mains
   6. Chilled water mains
   7. Conveying systems
   8. Significant conduit runs
   9. Cable trays
   10. Contract ceiling heights
   11. Soffits
   12. Access points
   13. Fire wall penetrations
   14. Steam and condensate mains
   15. Gas, water, and process piping

N. Information delineated shall be distance from column centerlines, pipe/equipment size, and distance from finished floor to bottom of pipe/equipment and hangers. Included on the Drawings shall be piping layout with hanger locations and hanger point loads. This information shall be developed satisfactorily enough to allow the Structural Engineer to verify the adequacy of the structural system for the projected loads. The hanger locations may have to be moved depending on the structural system review. No hanger shall be fabricated and/or installed until the hanger locations are reviewed and accepted by the Architect/Engineer.

O. Within a period not to exceed two weeks after distribution of the drawings, the General Contractor will schedule a meeting with the Architect/Engineer and participating Contractors at which time areas of conflict shall be resolved. The drawings shall be overlaid to identify areas of conflict. All parties shall then cooperate in resolving the conflicts. Records of the agreements shall be entered on the Ventilating Contractor's drawings, acknowledged by all participants by signature in space provided for this purpose, and two copies distributed to all involved parties. All coordination drawing preparation and reproduction costs shall be borne by the Ventilating Contractor. The above drawings, review, and coordination process shall be repeated until all areas on the Project have been coordinated.

P. In the event a Contractor fails to cooperate in the Coordination Program, they shall be held responsible for all costs incurred for adjustments to the work of others made necessary to accommodate the uncooperative Contractor's installations.

1.22 REQUEST AND CERTIFICATION FOR PAYMENT

A. Within 10 days after Notice to Proceed, the successful bidder will submit to the Owner's Project representative in a form prescribed by Division 1, a cost breakdown of the proposed values for work performed which, if approved by the Owner's project representative, will become the basis for construction progress and monthly payments. The cost breakdown items shall reflect actual work progress stages as closely as feasible.
B. In addition, if payment will be requested for approved off-site stored material, then that material shall be listed as a line item in the request and certification for payment cost breakdown.

1.23 SLEEVES AND OPENINGS

A. Openings required in new or existing construction that may be necessary for the installation of new work shall be provided by the respective contractor and all patching and repairing shall be done by workmen competent in the trade required, at the expense of the respective contractor. The respective contractor shall be responsible for arranging the work so that minimum cutting will be required. All rubbish and excess materials involved in such cutting shall be promptly removed from the site and disposed of by the contractor. Cutting through the floor or roof systems or load bearing walls shall be done only with the prior written approval of the Architect/Engineer so as to avoid damaging the structural system.

1.24 OMISSIONS

A. No later than ten (10) days before bid opening, the Contractor shall call the attention of the A/E to any materials or apparatus the Contractor believes to be inadequate and to any necessary items of work omitted.

B. Where local or national codes apply, the contractor shall provide all devices necessary to meet the code, regardless of whether they are indicated on the prints or not.
   16. Example:
      a. (If) Nurse Call system is indicated on the plans and patient or staff call devices are indicated, but one room or rooms are inadvertently not shown on the plans with the required devices, the contractor shall price and provide such devices.
      b. Code may require a staff station in clean or soiled utility room, but the plans neglect to show that due to a clerical or CAD error, but the bidding contractor knows that a call device is required, the contractor shall price and provide such devices.
      c. Where dome lights are required by code but some are inadvertently not indicated on the prints, the contractor shall price and provide such devices.
      d. The Contractor shall price in his bid and provide all such devices as required by code. If there is any question regarding any device, the contractor shall submit an official RFI (request for information) through official channels prior to the bid date. If no RFI is provided by the contractor and no answer is given by the engineer, the contractor shall provide all such devices required to meet code and include those devices in the bid price.

1.25 DEFINITIONS

A. Backbone Cabling - Cables connecting TRs from lower level to upper level or between TRs. Term also applies to outside plant cabling between buildings.
B. BEF - Building Entrance facility – Voice, data and video services are brought from the street into building in this room.
C. Cable - Assembly of one or more conductors or optical fibers within enveloping sheath, constructed so as to permit use of conductors singly or in groups.
D. Cable Link - Includes SIO, station cable and termination hardware in TR.
E. Cable Channel - Same as Cable Link, plus patch cords at SIO and in TR.
F. Consolidation Point – Also known as zone distribution box (ZDB). Intermediate point having multiple terminations between SIO and TR to simplify moves, adds and changes, bringing final terminations closer to SIOs.
G. Cross-Connect - Group of connection points, wall or rack mounted, used to mechanically terminate and administer building wiring.

H. Entrance Room (ER) – (also Equipment Room) A combination of BEF and MDF in one room. All building voice, data and video services are distributed to TRs on all levels from this room. Cables to all outlying campus buildings are terminated and distributed from the ER. ERs are on floor 2.
I. Faceplate – a covering placed over a recessed back box that contains one or more openings to house individual jacks.
J. Horizontal Cabling - Cables connecting SIOs to TRs.
K. Jack – a single outlet consisting of a single connector attached to a single cable assembly. Multiple jacks may be installed into a single faceplate.
L. MDF - Main Distribution Frame – Same as BEF or ER.
M. OFCI – Owner furnished, contractor installed.
N. OFOI – Owner furnished, owner installed
O. CFCI – Contractor furnished, contractor installed
P. OSP – Outside Plant (refers to equipment, conduit and installation contractor provided under separate contract to provide equipment beyond five feet from B2 building foundation.
Q. The term "provide" includes such labor, methods, materials, equipment and transportation or other facilities required to complete the Contract and the performance of all duties thereby upon the Contractor.
R. RU - Rack Unit - Each RU is 1.75" high.
S. SIO - Standard Information Outlet - A device assembly located in work area on which horizontal cabling terminates and which can receive modular connectors. Depending on the immediate context, an SIO may refer to either a faceplate configuration (i.e., an SIO having two standard data jacks – SIO = faceplate) or in other cases may refer to a single jack (i.e. SIO = one jack). In some cases, as in item T below, the distinction is irrelevant.
T. Telecommunications - Any transmission, emission, or reception of signs, signals, writings images, sounds or information of any nature by wire, radio, visual, optical or other electromagnetic systems.
U. TR – Telecommunications Room – Room used to cross connect backbone cable to horizontal station cable out to SIOs. May house network electronics. Also houses equipment for other systems such as CCTV and Access Control. Interchangeable with term IDF (Intermediate Distribution Facility). Usually one per floor to accommodate SIOs on that same floor.
V. MTR – Main Telecommunications Room – Same as IDF but usually larger and located on a lower floor to consolidate riser cables from multiple TRs. May also function as a building entrance facility to receive cables from outside service providers. Interchangeable with term MDF (Main Distribution Facility) and Equipment Room (ER).
W. UTP – Unshielded Twisted Pair Cabling

1.26 PROJECT/SITE CONDITIONS

A. Install Work in locations shown on Drawings, unless prevented by Project conditions.
B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of A/E before proceeding.
C. Tools, materials and equipment shall be confined to areas designated by the Owner's project representative.

1.27 WORK SEQUENCE AND SCHEDULING

A. Install work in phases to accommodate Owner's occupancy requirements. During the construction period coordinate schedule and operations with Owner's Construction Representatives.

1.28 SALVAGE MATERIALS

A. No materials removed from this project shall be reused (except as specifically noted below). All materials removed shall become the property of and shall be disposed of by the Contractor.

1.29 PERFORMANCE TESTING

A. Each system included in project scope shall be tested to verify performance.
B. Systems that require a performance warranty (such as data cable) shall be tested to comply with manufacturer's requirements in order to obtain the system warranty.
C. Some systems have specific testing procedures (fiber optic cable).

D. Systems not having specific testing criteria shall utilize the Systems Checklist described in Part 3 below.

1.30 DESCRIPTION

A. Structured cabling system is a complete collective configuration of cabling and associated hardware on a premises which, when installed, provides a comprehensive telecommunications infrastructure. Systems shall include backbone and station data, voice, and video and fiber optic cable as indicated on drawings.
B. Cables and equipment shall be provided, tested, and terminated, including proper grounding and bonding.
C. Voice Service is carried on copper cable, backbone data services are carried on fiber optic cable, and television service is carried on coaxial cable and copper cable.
D. Telecommunication distribution consists of Telecommunications Rooms (TR), fiber optic backbone, category 3 or voice grade copper backbone, category 6 copper data station cable, wall and floor box outlets, cable tray and conduit.
E. TRs are located throughout facility.
F. No UTP station cable link shall be longer than 90 meters.
G. Cabling system is intended to be a "universal" system with no distinction between voice and data.
H. Cabling to be plenum rated where noted and where environment dictates plenum rated cabling.
I. Systems shall be delivered in complete functioning condition.
J. Coordinate with owner as required to obtain owner furnished items.

1.31 DIMENSIONS AND DEFINITE LOCATIONS

A. The Drawings depicting Work show approximate locations. The exact location of equipment and devices shall be established in the field in accordance with instructions from the Owner. Consideration shall be given to construction features, equipment of other trades, and requirements of the equipment proper.
B. The Contractor shall refer to Shop Drawings and submittal drawings for all equipment requiring electrical connections to verify rough-in and connection locations.
C. Unless specifically stated to the contrary, no Drawing by scale shall be used as a dimension to Work by. Dimensions noted on the Drawings are subject, in each case, to measurements of adjacent or previously completed Work and all such measurements necessary shall be taken before undertaking any Work dependent upon them.

1.32 TRAINING

A. Refer to Section 01 91 13 - Commissioning Requirements for training requirements.
B. The contractor shall have the following responsibilities:
    1. Provide a training plan sixty days before the planned training covering the following elements:
        a. Equipment
        b. Intended audience
        c. Location of training
        d. Objectives
        e. Subjects covered (description, duration of discussion, special methods, etc.)
        f. Duration of training on each subject
        g. Instructor for each subject
        h. Methods (classroom lecture, manufacturer's quality video, site walk-through, actual operational demonstrations, written handouts, etc.).
    2. Provide designated owner personnel with comprehensive orientation and training in the understanding of the systems and the operation and maintenance of each piece of equipment that makes up the system.
    3. Training shall normally start with classroom sessions followed by hands-on demonstration/training on each piece of equipment.
    4. During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system shall be repaired or adjusted as necessary and the demonstration repeated at another scheduled time, if necessary.

5. The appropriate trade or manufacturer's representative shall provide the instructions on each major piece of equipment. Practical building operating expertise as well as in-depth knowledge of all modes of operation of the specific piece of equipment are required. More than one party may be required to execute the training.
6. The controls contractor shall attend sessions other than the controls training, as specified, to discuss the interaction of the controls system as it relates to the equipment being discussed.
7. The training sessions shall follow the outline in the table of contents of the operation and maintenance manual and illustrate whenever possible the use of the O&M manuals for reference.
8. Training shall include:
    a. Use of the printed installation, operation and maintenance instruction material included in the O&M manuals.
    b. A review of the written O&M instructions emphasizing safe and proper operating requirements, preventative maintenance, special tools needed and spare parts inventory suggestions. The training shall include startup, operation in all modes possible, shutdown, seasonal changeover and any emergency procedures.
    c. Discussion of relevant health and safety issues and concerns.
    d. Discussion of warranties and guarantees.
    e. Common troubleshooting problems and solutions.
    f. Explanatory information included in the O&M manuals.
    g. Discussion of any peculiarities of equipment installation or operation.
    h. Classroom sessions shall include the use of overhead projections, slides, video/audio-taped material as might be appropriate.
    i. Hands-on training shall include startup, operation in all modes possible, including manual, shut-down, alarms, power failure and any emergency procedures, and preventative maintenance for all pieces of equipment.
9. The contractor shall fully explain and demonstrate the operation, function and overrides of any local packaged controls not controlled by the central control system.

C. Video recording of the training sessions will be provided by the contractor and added to the O&M manuals. In addition, factory training videos identifying key troubleshooting, repair, service and/or replacement techniques shall be provided and reviewed with the owner.
D. Provide a minimum of 8 hours of instruction.
E. Provide additional training as specified in other specification sections for specific equipment.

PART 2 – PRODUCTS

2.01 ACCESS PANELS AND DOORS

A. Lay-In Ceilings:
    1. Removable lay-in ceiling tiles in 2 x 2 foot or 2 x 4 foot configuration provided under Division 9 are sufficient; no additional access provisions are required unless specifically indicated.
B. Concealed Spline Ceilings:
    1. Removable sections of ceiling tile held in position with metal slats or tabs compatible with the ceiling system used will be provided under Division 9.
C. Metal Pan Ceilings:
    1. Removable sections of ceiling tile held in position by pressure fit will be provided under Division 9.
D. Plaster Walls and Ceilings:
    1. 16 gauge frame with not less than a 20 gauge hinged door panel, prime coated steel for general applications, stainless steel for use in toilets, showers and similar wet areas, concealed hinges, screwdriver operated cam latch for general application, key lock for use in public areas, UL listed for use in fire rated partitions if required by the application. Use largest size access opening possible, consistent with space and the equipment needing service; minimum size is 12" by 12".

2.02 IDENTIFICATION

A. Refer to Section 27 05 53 – Identification for Communication Systems.

2.03 SEALING AND FIRESTOPPING

A. Fire and/or Smoke Rated Penetrations:
   1. Manufacturers:
      a. 3M, STI/SpecSeal, Tremco, Hilti
      b. All firestopping systems shall be by the same manufacturer.
   2. Submittals:
      a. Contractor shall submit product data for each firestop system. Submittals shall include product characteristics, performance and limitation criteria, test data, MSDS sheets, installation details and procedures for each method of installation applicable to this project. For non-standard conditions where no UL tested system exists, submit manufacturer's drawings for UL system with known performance for which an engineering judgment can be based upon.
   3. Product:
      a. Firestop systems shall be UL listed or tested by an independent testing laboratory approved by the Owner and the Authority Having Jurisdiction (AHJ).
      b. Use a product that has a rating not less than the rating of the wall or floor being penetrated. Reference architectural drawings for identification of fire and/or smoke rated walls and floors.
      c. Contractor shall use firestop putty, caulk sealant, intumescent wrapstrips, intumescent firestop collars, firestop mortar or a combination of these products to provide a UL listed system for each application required for this project. Provide mineral wool backing where specified in manufacturer's application detail.
      d. All sealants shall meet the intent of LEED® VOC requirements, <250 g/L VOC contents (less H_20 and exempt solvents).

B. Non-Rated Penetrations:
   1. Conduit Penetrations Through Below Grade Walls:
      a. In exterior wall openings below grade, use a modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the uninsulated conduit and the cored opening or a water-stop type wall sleeve.
   2. Conduit and Cable Tray Penetrations:
      b. At conduit and cable tray penetrations of non-rated interior partitions, floors and exterior walls above grade, use urethane caulk in annular space between conduit and sleeve, or the core drilled opening.

PART 3 – EXECUTION

3.01 DEMOLITION

A. Perform all demolition as indicated on the drawings to accomplish new work. Where demolition work is to be performed adjacent to existing work that remains in an occupied area, construct temporary dust partition to minimize the amount of contamination of the occupied space. Where pipe is removed and not reconnected with new work, cap ends of existing services as if they were new work. Coordinate work with the Owner to minimize disruption to the existing building occupants.

B. All pipe, fixtures, equipment, wiring and associated conduit, insulation and similar items demolished, abandoned, or deactivated are to be removed from the site by the Contractor except as specifically noted otherwise. All designated equipment is to be turned over to the owner for their use at a place and time so designated. Maintain the condition of material and/or equipment that is indicated to be reused equal to that existing before work began.

C. All contractors requiring the personnel/ material hoist and or temporary construction elevator (i.e. new elevators, temporarily protected) at times other than outlined in the temporary facilities specifications will make arrangements directly with the general contractor. The general contractor is responsible for all coordination and scheduling of the use of any hoisting equipment, so the flow of the project is smoothly maintained and all workers have access to the work areas to perform their work and deliver material to the areas needed according to the project schedule.

D. If any contractor's work requires the removal and replacement of any finished materials including but not limited to such materials as ceiling tiles, wall finishes, cabinets, doors, flooring, windows, etc. after those items are installed, each contractor will be responsible, at no additional cost to the owner, to replace any damaged, soiled or lost materials with new materials to match the existing materials and those materials damaged.

3.02 CUTTING AND PATCHING

A. Refer to Division 1 for cutting and patching. In addition to the requirements in Division 1:
B. Each Contractor shall coordinate the placing of openings in the new structure as required for the installation of each Contractor's work.
C. Each Contractor shall furnish to the General Contractor the accurate locations and sizes for required openings in the new work, but this shall not relieve each Contractor of the responsibility of checking to assure that properly sized openings are provided. When additional patching is required due to the Contractor's failure to inspect this work, then the Contractor shall make arrangements for the patching required to properly close the openings to include patch painting, and the Contractor shall pay any additional cost incurred in this respect.
D. If cutting and patching of the new structure is made necessary due to the Contractor's failure to install piping, ducts, sleeves, or equipment on schedule, or due to the Contractor's failure to furnish on schedule the information required for the leaving of openings, then it shall be the Contractor's responsibility to make arrangements and obtain approval from the General Contractor and Architect/Engineer for this cutting and patching, and the Contractor shall pay any additional cost incurred in this respect. The Contractor shall also reimburse the Owner for any additional costs incurred to the Architect/Engineer for additional services caused by the Contractor in this respect.
E. The Contractor shall provide cutting and patching and patch painting in the existing structure as required for the installation of his Work and shall furnish lintels and supports as required for openings. Cutting of structural support members will not be permitted without prior approval of the Architect/Engineer. Extent of cutting shall be minimized; use core drills, power saws, or other machines which will provide neat, minimum openings. Patching shall match adjacent materials and surfaces and shall be performed by craftsmen skilled in the respective craft required.

3.03 BUILDING ACCESS

A. Arrange for the necessary openings in the building to allow for admittance of all apparatus. When the building access was not previously arranged and must be provided by this contractor, restore any opening to its original condition after the apparatus has been brought into the building.

3.04 EQUIPMENT ACCESS

A. Install all piping, conduit, ductwork, and accessories to permit access to equipment for maintenance. Coordinate the exact location of wall and ceiling access panels and doors with the General Contractor, making sure that access is available for all equipment and specialties. Where access is required in plaster or drywall walls or ceilings, furnish the access doors to the General Contractor and reimburse the General Contractor for installation of those access doors.

3.05 COORDINATION

A. The Contractor shall cooperate with other trades in locating work in a proper manner. Should it be necessary to raise or lower or move longitudinally any part of the electrical work to better fit the general installation, such work shall be done at no extra cost to the Owner, provided such decision is reached prior to actual installation. The Contractor shall check location of electrical outlets with respect to other installations before installing.
B. The Contractor shall verify that all devices are compatible for the surfaces on which they will be used. This includes, but is not limited to light fixtures, panelboards, devices, etc. and recessed or semi-recessed heating units installed in/on architectural surfaces. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls and other structural components as they are constructed.
C. Coordinate all work with other contractors prior to installation. Any installed work that is not coordinated and that interferes with other contractor's work shall be removed or relocated at the installing contractor's expense.

D. Coordinate with Division 27 and 28 contractors and equipment vendors for proper location, quantity and capacity of all required conduits, back boxes, device rings and power supplies required to support systems specified.

3.06 SEALING AND FIRESTOPPING

A. The Contractor shall refer to building life safety drawings for all smoke and fire rates in addition to the mechanical drawings. Any discrepancies shall be brought to the attention of the Architect/Engineer before final addendum.
B. Fire and/or Smoke Penetrations:
   1. Install approved product in accordance with the manufacturer's instructions where a pipe (i.e. cable tray, bus, cable bus, conduit, wireway, trough, etc.) penetrates a fire rated surface.
   2. Where firestop mortar is used to infill large fire-rated floor openings that could be required to support weight, provide permanent structural forming. Firestop mortar alone is not adequate to support any substantial weight.
C. Non-Rated Surfaces:
   1. When the opening is through a non-fire rated wall, floor, ceiling or roof the opening must be sealed using an approved type of material.
   2. Install escutcheons or floor/ceiling plates where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces for this paragraph include only those rooms with finished ceilings and the penetration occurs below the ceiling.
   3. In exterior wall openings below grade, assemble rubber links of mechanical seal to the proper size for the conduit and tighten in place, in accordance with the manufacturer's instructions. Install so that the bolts used to tighten the seal are accessible from the interior of the building or vault.
   4. At interior partitions, conduit penetrations are required to be sealed for all clean rooms, laboratories, and most hospital spaces, computer rooms, dormitory rooms, tele/data/com rooms and similar spaces where the room pressure or odor transmission must be controlled. Apply sealant to both sides of the penetration in such a manner that the annular space between the conduit sleeve and the conduit is completely filled.

3.07 HOUSEKEEPING AND CLEAN UP

A. The Contractor shall clean up and remove from the premises, on a daily basis, all debris and rubbish resulting from its work and shall repair all damage to new and existing equipment resulting from its work. When job is complete, this Contractor shall remove all tools, excess material and equipment, etc., from the site.

3.08 CABLE INSTALLATION

A. Furnish all required installation tools to facilitate cable pulling without damage to cable jacket.
B. During pulling operation adequate number of workers shall be present to allow cable observation at all points of raceway entry and exit, as well as to feed cable and operate pulling machinery.
C. Pull cables in accordance with cable manufacturer's recommendations and ANSI/EEE C2 Standards.
D. Recommended pulling tensions and bending radii shall not be exceeded.
E. Any cables bent or kinked to radius less than recommended dimension are not allowed and shall be replaced at no expense to Owner.
F. Pull all cable by hand unless installation conditions require mechanical assistance.
G. Where mechanical assistance is used, ensure that maximum tensile load for cable is not exceeded. This may be in the form of continuous monitoring of pulling tension, use of "break-away" or other approved method.
H. Install cable in conduit or metal raceway system (cable tray or equivalent) in public areas and as designated on plans. Certain routes may require cable to be run outside of cable tray.
I. All routing shall be kept clear of other trades work and supported utilizing j-hooks.
J. J-hook cable supports shall be installed in accordance with manufacturers' installation requirements.
K. Provision of j-hooks is not indicated on drawings. Contractor is responsible to provide j-hooks along any route where cable tray or conduit is not available. Change orders for j-hooks will not be accepted even if cable routes must change due to lack of cable tray, avoidance of structures or other utilities or route changes due to cable length problems. All jack symbols shall assume provision of cable support including j-hooks, cable tray or conduit.

L. Change orders for additional j-hooks, conduits or cable tray will not be accepted for route changes or changes in cable length unless pre-authorized by engineer.
M. Cable should be provided within cable tray wherever possible and practical. Cable tray may be indicated on project documents along major routes only. Some cable may need to take alternate routes outside of cable tray to reach destination in order to stay within the cable length limit. Where installed cable does not follow cable tray, contractor shall plan for all required j-hooks and sleeves to accommodate alternate routes. Example: during bidding contractor assumes certain cables will follow cable tray route. But during installation it is discovered that route causes cable to be over the length limit, forcing another route. The alternate route requires additional J-hooks and sleeves that were not planned during bidding. Since neither the owner nor engineer provide explicit directions for routing of every cable, and since the project scope or jack quantity did not change, the contractor shall take responsibility for measuring and planning of all cable routes and provision of all support and sleeve devices as required without incurring additional charges to the project.
N. Spacing of J-hook cable supports shall be minimum every 4 ft. or in accordance with cable manufacturers' specifications, whichever distance is shorter. Under raised floor provide every 2 ft. or on every vertical support.
O. J-hook fill capacities shall be:
   1. 1" diameter, 16 UTP 4 pair cables.
   2. 2" diameter, 50 UTP 4 pair cables.
   3. 4" diameter, 80 UTP 4 pair cables.
P. Cable in MDF/TR shall be routed and supported utilizing "D-type" mounting rings, J-hooks and overhead cable runway.
Q. Use of circular bridle rings made of round stock is not acceptable for cable support. Any support device must have a flat bottom (such as j-hooks) to adequately support cable without deforming cable at point of support.
R. Repair damage to interior spaces caused by installation of cable, raceway or other hardware, Repairs must match preexisting color and finish of walls, floors and ceilings.
S. Replace contractor-damaged ceiling tiles to match color, size, style and texture.
T. Avoid abrasion and other damage to cables during installation. Any cable having visible abrasions that have worn through the outer sheath shall be replaced at contractor's expense, whether the cable passes the certification test, or not.
U. Provide plastic bushings on the end of every conduit or sleeve that is utilized for cable. Use of conduits or sleeves WITHOUT the provision of plastic bushings to protect the end of the conduit may be cause for removal and replacement of all cables utilizing that conduit or sleeve.
V. Pulling lubricant may be used and shall:
   1. Be non-injurious to cable jacket and other materials used.
   2. Not harden or become adhesive with age.
W. Pull cord (200 lb. minimum) shall be installed with cable installed in conduit and innerduct.
X. Provide to Engineer, prior to installation, drawings showing proposed installation for approval.
Y. Install cables splice-free unless otherwise specified.
Z. Cabling shall be neatly laced, dressed and supported.

3.09 TESTING

A. Contractor shall:
   1. Submit schedule for acceptance testing. Representatives of Owner and/or Engineer may witness test procedures.
   2. Notify Owner and Engineer a minimum of 2 days in advance to allow for such participation.
   3. Conduct tests during course of construction when identifiable portion of installation is complete. Alternatively, testing can be conducted after entire installation is complete if this does not delay the project schedule.
   4. Describe test procedures prior to testing and submit sample test form to Engineer. Submit 3 record copies, and one electronic copy in CSV format, of results of tests to Engineer for approval.
   5. Alternatively, Contractor may submit proprietary electronic format test results, including software to access and print results. Software shall be Windows™ compatible.
B. Testing shall be completed and accepted by Owner and Engineer before Owner furnished equipment and cross connects are installed.

C. Test results shall be provided to manufacturer in order to obtain complete cable system warranty within 30 days of project completion. Provide original warranty certificate to owner and one copy to engineer.
D. Provide as-built jack plans and other as-built documentation as determined by field labeling or other changes to project documents.
E. The contractor is responsible to assure that all individual components and integrated systems (especially electronic systems) are fully functioning and in good working order before notifying Engineer or Owner for acceptance testing, inspection or final punch list completion.

3.10 SYSTEMS CHECKLIST

A. For all systems having an electronic equipment component (active electronics) a system checklist shall be developed and utilized by the contractor.
B. The systems checklist shall make note of all major electronic components and systems.
C. It shall utilize a simple method to make notations of the equipment, that they
   1. Function individually as designed
   2. Have been calibrated or adjusted
   3. Function as an integrated system with other components
D. The checklist shall be utilized in the field by the contractor and filled out appropriately prior to contracting owner or engineer to witness tests, provide inspections or complete final punch list.
E. The checklist shall have a signature line for three entities: Contractor/supervisor, owner and engineer.
F. A completed, signed checklist (by Contractor) shall be presented to the engineer prior to performing the punch list and prior to final owner sign-off or project completion.
G. Examples of systems that might require a checklist: Access Control, Closed Circuit TV system (security cameras), Audio-Visual systems, Area of Rescue, Digital Signage, Nurse Call and other system that utilizes active electronics.
H. It is the responsibility of the Contractor, not the Engineer or Owner, to assure that all systems function according to the design intent of the project documents and according to all manufacturer's recommendations prior to project completion. The Systems Checklist shall be utilized by the Contractor and presented to the Engineer or Owner as verification that all systems have been tested, adjusted and are in good working order.
I. The Systems Checklist shall be included as part of the Operations and Maintenance manual to be submitted at project completion.

END OF SECTION

APPENDIX A

COMMUNICATION QUALIFICATION REQUIREMENTS

TABLE OF ARTICLES

1. GENERAL

2. TECHNICIAN/INSTALLER QUALIFICATIONS

3. CONTRACTOR QUALIFICATION REQUIREMENTS

COMMUNICATIONS QUALIFICATION REQUIREMENTS

ARTICLE 1 - GENERAL

1.1 GENERAL

1.1 This document specifies the minimum technical qualifications required of Communications Subcontractors and Technicians participating in the construction this project.

1.2. This document is part of the Contract Documents. The Communications subcontractor acknowledges that all Technicians performing communications work on the Project meet the technical qualifications specified herein. This document will serve as a metric to evaluate quality control and quality of work throughout the Project, including workmanship, code and standards compliance, methods, practices, accuracy of work, efficiency, and other trade related work items.

1.3 The Communication Subcontractor must be able to demonstrate the capacity to satisfy all sections of this qualification document. The Owner reserves the right to require supporting documentation from the Communications subcontractor to verify that all qualification requirements specified herein for participation on the Project have been met.

1.2 CONTRACTORS AND SUBCONTRACTORS

1.2.1 The minimum work anticipated for the Project includes Communications cable installation, termination, documentation, labeling and testing.

1.3 SCOPE OF WORK

1.3.1 In brief the Project requires:

.1 Communications cabling work may include any combination of the following: new copper and optical fiber backbone cable throughout the facility; new horizontal cabling to work area outlets; and termination, labeling, and testing of new communication cabling infrastructure. New cabling will be terminated in either existing or new Telecommunication Rooms (TRs).

.2 Service activation work includes activating new circuits in a very methodical, organized, pre-planned, and logical approach, for both voice and data services. Activation records may be provided by the Owner. Refer to Part 1 – General for scope of project. Service activation is often carried out by owner.

1.4 OWNER FURNISHED MATERIALS

1.4.1 Owner will furnish and install all electronic voice and data equipment (Switches, routers, etc.)

1.4.2 The Contractor shall provide all other materials not furnished by the Owner including all horizontal UTP cable, all Coax cabling and compression fittings, all optical-fiber backbone cable, all termination hardware, both at the (WAO) work area outlet location (faceplates, Jacks, F-connector modules, blanks, labels, icons) and at the (TR) telecommunication room (termination blocks, frames, rod-mounts, jumper wire, relay racks, fiber termination hardware, panels, and connectors, multi-pair copper backbone cable, ground bars, bonding conductors, fasteners, supporting devices, cable ties, ladder rack, conduit, raceway, and other items not identified here but required for complete installation).

ARTICLE 2 – TECHNICIAN/INSTALLER QUALIFICATION

2.1 General

2.1.1 Technician/Installer qualification requirements are those required of Technician/Installer within the trade(s) under which they are participating on the Project.

2.1.2 The qualification requirements are the minimum requirements.

2.1.3 The categories below define the general scope of work by function. The category is not exhaustive of the work details.

2.1.4 Qualification requires that all of the items in the category are satisfied.

2.2 Communications Cabling Work

2.2.1 Communications cabling work includes installation, termination, and testing of multi-pair copper communications cable (e.g., 25-pair, 1200-pair, etc.); installation, termination, and testing of multi-strand optical fiber communications cable; installation, termination, and testing of category 6, 4-pair UTP communications station cable; Installation, termination, and testing of coax RG-11/RG-6 cabling, labeling of cables, WAO's and hardware; installation of equipment racks; installation of cable management hardware; and installation of termination frames, wall fields, and hardware.

2.2.2 Qualified Technician/Installers shall perform communications cabling work on the Project as follows:

.1 Only qualified BICSI Technicians/Installers or those under direct on-site supervision of a BICSI Certified Technician shall install copper and fiber cable. Qualified Technician/Installers installing copper and fiber cable are those who:

.1 Are familiar with and routinely install communications cable in accordance with the methods specified in industry standard TIA/EIA 568-B and C, Commercial Building Communications Cabling Standard.

.2 Are familiar with and routinely install communications pathways in accordance with the methods specified in industry standard TIA/EIA 569-A, Commercial Building Standard for Communications Pathways and Spaces.

.3 Are familiar with the National Electrical Code adopted by the local Authority Having Jurisdiction and as applicable to cable installation to the extent that the methods and practices used to install communications cable comply with the Code.

.4 Install twisted-pair category 6 UTP communications cable routinely.

.5 Install multi-pair riser cable and optical fiber riser cable routinely.

.6 Install coax RG-11 and RG-6 cabling with compression connectors routinely.

.7 Have a minimum of one year of experience installing, routing, support, and placement of category 6 communications cable and multi-pair riser cable and optical fiber riser cable.

.8 Are accustomed to, familiar with, and routinely use tools and equipment for installation of multiple reels and large volumes of category 6 UTP, multi-pair copper cable, coaxial RG-11 and RG-6 cable, and SM/MM optical fiber riser cable.

.9 Are accustomed to, familiar with, and routinely apply typical industry practices and methods for installation and support of multi-pair cable and category 6 twisted pair UTP communications cable and optical fiber riser cable.

.10 Are a BICSI Certified Installer or are under the direct supervision of an on-site foreman who is a current BICSI Certified Technician and could provide copy of current updated certificate.

.2 Only qualified BICSI Technicians/Installers or those trained specifically by the manufacturer of the cabling systems to be installed shall terminate and test copper cable. Qualified technicians terminating and testing copper cable are those who:

.1 Routinely install, terminate, and test the cable and connectivity products specified herein, or proposed on the bid.
.3 Are accustomed to, familiar with, and routinely use Level III and Level IV certification testers for twisted pair category 6 UTP communications cables and are knowledgeable to interpret and trouble shoot test results.
.4 Are a current BICSI Certified Technician, a Certified BICSI Installer or certified by the manufacturer of the cabling system to be installed and could provide copy of current certification certificate.

.3 Only qualified Technicians shall splice copper cable. Qualified Technicians/Installers splicing copper cable are those who:
.1 Routinely terminate multi-pair copper cable.
.2 Are accustomed to, familiar with, and routinely use tools and equipment for splicing multi-pair cables.
.3 Are accustomed to, familiar with, and routinely use test equipment to verify correct pair splicing and are knowledgeable to interpret and trouble shoot test results.
.4 Are a current BICSI Certified Technician and could provide copy of current certification certificate.

.4 Only qualified Certified Technicians shall splice, terminate, and test optical fiber cable. Qualified Technicians splicing, terminating, and testing optical fiber cable are those who:
.1 Routinely install and terminate multimode and single mode tight-buffered optical fiber cable.
.2 Routinely fusion splice optical fiber cable.
.3 Routinely install SC/ST/LC type connectors using 3M Hot Melt, Corning Quick Connect, and two parts epoxy methods.
.5 Are accustomed to, familiar with, and routinely use a power meter and light source for testing optical fiber and are knowledgeable to interpret and trouble shoot test results.
.6 Are accustomed to, familiar with, and routinely use OTDR for testing optical fiber and are knowledgeable to interpret and trouble shoot test results.
.7 Are a current Certified Technician and could provide copy of current certification certificate.

ARTICLE 3 - CONTRACTOR QUALIFICATION REQUIREMENTS

3.1 General
3.1.1 Contractor qualification requirements are those required of the Contractor to perform the work on the Project.
3.1.2 The qualification requirements are the minimum requirements.
3.1.3 Qualification requires that all of the items in each category are satisfied and support documentation submitted to owner.

3.2 Project Administration
3.2.1 The nature of the Project work necessitates a formally defined process of administration. Project administration includes project scheduling; crew scheduling; materials handling; tracking field changes; etc.
3.2.2 Qualified Contractors are those who:
.1 Have experience managing projects equal to or larger than the project being bid.
.2 Are accustomed to, familiar with, and routinely use formal project administration practices and procedures.
.3 Have provided large project scheduling and are accustomed to and familiar with large project scheduling practices.
.4 Are accustomed to, familiar with, and routinely use project scheduling software.

3.3 Project Staffing

3.3.1 The Project size and schedule requires teams of qualified Technicians/Installers performing work throughout the building. In general each team shall be dedicated to the Project until the work is complete in an effort to assure work continuity, familiarity with the Project and quality control. Teams include both qualified Technicians/Installers and supervisory personnel such as Project Managers. Those with PMP, TPM, or RCCD designation are desirable.

3.3.2 Staffing requirements are driven by the building construction schedule.

3.3.3 Qualified Contractors are those who:

.1 Have a minimum of 5 years' experience in this field of work.

.2 Can provide a dedicated team of qualified Technicians to complete the communications construction work within the construction time framed outlined by construction contractor and owner.

.3 Have a Registered Communications Distribution Designer (RCDD) or certified BICSI ITS Technician on staff to ensure project quality control and adherence to industry Communications standards as required by the project specifications.

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SECTION 27 05 26
GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 – GENERAL

1.01 SECTION INCLUDES
A. Grounding and Bonding Conductors
B. Splices and Termination Components
C. Grounding Busbars
D. Grounding Connections
E. Equipment Rack and Cabinet Grounding Busbars
F. Grounding Terminal Blocks
G. Splice Case Grounding Accessories
H. Labels

1.02 RELATED WORK
A. Section 26 05 00 - Common Work Results for Electrical
B. Section 26 05 26 - Grounding and Bonding for Electrical Systems
C. Section 26 05 53 – Identification for Electrical Systems
D. Section 26 08 00 – Commissioning of Electrical Systems
E. Section 27 05 00 - Common Work Results for Communications Systems
F. Applicable Publications
   1. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
   2. American Society for Testing and Materials (ASTM):
      a. B1-2001 Standard Specification for Hard-Drawn Copper Wire
      b. B8-2004 Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
   3. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
      a. 81-1983 IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
   4. National Fire Protection Association (NFPA):
      a. 70-2005 National Electrical Code (NEC)
   5. Telecommunications Industry Association, (TIA)
      a. J-STD-607-A-2002 Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.
   6. Underwriters Laboratories, Inc. (UL):
      a. 83-2003 Thermoplastic-Insulated Wires and Cables
      b. 467-2004 Grounding and Bonding Equipment

1.03 SUBMITTALS
A. Submit shop drawings for equipment under this section per requirements listed herein, as well as per section 01 30 00.
B. Submittals shall be grouped with related systems
C. Submit catalog sheets or photocopies. Do not submit hard copies of web pages. Web pages change frequently and will be rejected.
D. Circle noted item with black pen or use arrows that can be copied.
E. At end of project submit record documents, as-builts, certificates, warranties and other operational manual documents to assist owner to maintain all systems.
F. Work shall not proceed without Engineer's approval of submitted items. Materials that are installed without Engineer approval risk forced removal by contractor at Engineer request.
G. Shop Drawings:
   1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.

2. Include the location of system grounding electrode connections and the routing of aboveground and underground grounding electrode conductors.

1.04 PERFORMANCE TESTING

A. Test Report: Provide to Engineer a certified test report of ground resistance with explanation of procedure. At a minimum test shall include links from TGB to TMGB and TMGB to main electrical ground bus.
B. Certifications: Two weeks prior to final inspection, submit four copies of the following to the Engineer:
   1. Certification that the materials and installation is in accordance with the drawings and specifications.
   2. Certification that the entire installation has been properly installed and tested.

1.05 WORK INCLUDES

A. Complete communications grounding and bonding system dedicated to the use of communications systems, but connected to the main electrical service ground of the building.
B. Grounding risers, backbones, bus bars, equipment bonds, 2-hole connectors, paint-piercing washers, labels, and all supporting equipment to provide a complete installation as indicated on the project documents.
C. This section specifies general grounding and bonding requirements of telecommunications installations.
D. "Grounding electrode system" refers to all electrodes required by NEC as well as supplementary, telecommunications system grounding electrodes.
E. The terms "connect" and "bond" are used interchangeably in this specification and have the same meaning.

1.06 DESCRIPTION

A. System includes two major components:
   1. Riser system consisting of copper bus bars in TRs and MTR, large wire size riser conductors.
   2. Local system within TRs consisting of smaller conductors to each system component.

1.07 DEFINITIONS

A. TGB - Telecommunications Ground (Bus) Bar
   1. New Term: Secondary Bonding Busbar (SBB)
B. TMGB – Telecommunications Main Ground (Bus) Bar
   1. New term: Primary Bonding Busbar (PBB)
C. TBB – Telecommunications Bonding Backbone – Grounding Riser Conductor cable of large wire size connecting TGB to TMGB.
D. Grounding Equalizer (GE)
   1. New term: Bonding Backbone Conductor (BBC)
E. Also used below raised floor tiles to connect floor pedestals and data cabinets.
F. TR – Telecommunications Room.
G. MTR – Main Telecommunications Room

PART 2 – PRODUCTS

2.01 GROUNDING AND BONDING CONDUCTORS

A. Equipment grounding conductors shall be insulated stranded copper, except that sizes 6 mm² (10 AWG) and smaller shall be solid copper. Insulation color shall be continuous green for all equipment grounding conductors. Where permitted, conductors larger than #4 may remain bare.
B. Bonding conductors shall be ASTM B8 bare stranded copper, except that sizes 6 mm² (10 AWG) and smaller shall be ASTM B1 solid bare copper wire.
C. TBB (Grounding Riser Conductor): TBB shall be in accordance with J STD-607A. Use a minimum 50mm² (1/0 AWG) stranded copper grounding conductor unless indicated otherwise.

2.02 SPLICES AND TERMINATION COMPONENTS

A. Components shall meet or exceed requirements of nationally recognized testing laboratory and be clearly marked with the manufacturer, catalog number, and permitted conductor size(s).
B. Use only HTAP crimp style splice connections when bonding one cable to another (same sized cables or different sized cables).
C. 14 ton electric, battery powered or manual crimping tools with appropriately sized dies for each splice connection.
D. Obtain special permission from Engineer before using exothermic welding technique to join conductors.

2.03 GROUNDING BUSBARS

A. Provide solid copper busbar, pre-drilled for (2) **two-hole lug** connections with a minimum thickness of 6 mm (1/4 inch) for wall and backboard mounting using standard insulators sized as follows:
   1. TGB: 12 inches x 4 inch
   2. TMGB: 20 inches x 4 inch
   3. Double lug hole pattern only
   4. Tinned to resist corrosion

2.04 GROUNDING CONNECTIONS

A. Above Grade:
   1. Bonding Jumpers: compression type connectors, using zinc-plated fasteners and external tooth lock washers. All connections shall be **Two-hole type.**
   2. Ground Busbars: **Two-hole** compression type lugs using tin-plated copper or copper alloy bolts and nuts.
   3. Rack and Cabinet Ground Bars: two-hole compression-type lugs using zinc-plated or copper alloy fasteners.
   4. Antioxidant compound shall be used for all bonding connections.
B. Cable Shields: Make ground connections to multipair communications cables with metallic shields using shield bonding connectors with screw stud connection.

2.05 EQUIPMENT RACK AND CABINET GROUNDING BUSBARS

A. Provide solid copper ground bars designed for mounting on the19" framework of open or cabinet-enclosed equipment racks with minimum dimensions of 4 mm thick by 19 mm wide (3/8 inch x ¾ inch).

2.06 GROUNDING TERMINAL BLOCKS

A. At any equipment mounting location (e.g. backboards inside of hinged cover enclosures) where rack-type ground bars cannot be mounted, provide screw lug-type terminal blocks.

2.07 SPLICE CASE GROUNDING ACCESSORIES

A. Splice case grounding and bonding accessories shall be supplied by the splice case manufacturer when available. Otherwise, use 6 AWG insulated ground wire with shield bonding connectors.

2.08 LABELS

A. Each conductor to be labeled at the TGB or TMGB indicating date of installation and destination or system to which the conductor is attached
B. Similar to Panduit product LTYK Bonding Conductor Label Kit
C. Machine produced black lettering on white or yellow background.
D. Tie-wrapped or attached to conductor in a secure manner.

PART 3 – EXECUTION

3.01 GROUNDING AND BONDING CONDUCTORS

A. General

1. Ground in accordance with the NEC and J-STD-607-A, as shown on drawings, and as hereinafter specified.
2. Equipment Grounding: Metallic structures (including building steel), enclosures, raceways, junction boxes, outlet boxes, cabinets, and other conductive items in close proximity with electrical circuits shall be bonded and grounded.
3. Install all conductors as straight as possible, using only long sweep bends when a change of direction is required. **Sharp 90s will be rejected**. DO NOT install conductors with sharp changes in direction, kinks, bends, or loops. Minimize length of cable whenever possible by taking the shortest route available.
4. Conductors, bends and splices shall be installed such that they "flow" (usually downward) toward the TGB or TMGB. See details.
5. Telecommunications Bonding Backbone (TBB) shall be one continuous conductor without breaks, connections or splices from the highest floor to the lowest. TBB may connect directly to TMGB or continue on to the main electrical service entrance.
6. Main Bonding Jumper: Bond the TMGB to the ground bus in the main electrical service equipment for the building.
7. Metallic Piping, Building Steel, and Supplemental Electrode(s):
   a. Confirm with Electrical Contractor that he has provided a grounding electrode conductor sized per NEC between the service equipment ground bus and all metallic water and gas pipe systems, building steel, and supplemental or made electrodes.

B. Telecommunications Systems
1. Bond telecommunications system grounding equipment to electrical grounding electrode system.
2. Telecommunications Conduit Systems:
   a. Ground all metallic conduit systems and cable trays for telecommunications.
3. Boxes, Cabinets, and Enclosures:
   a. Bond the equipment grounding conductor to each pull box, junction box, outlet box, device box, cabinets, and other enclosures used for telecommunications.
4. Furnish and install all wire and hardware required to properly ground, bond and connect communications raceway, cable tray, metallic cable shields, and equipment to a ground source.
5. Ground bonding jumpers shall be continuous with no splices. Use the shortest length of bonding jumper possible.
6. Provide ground paths that are permanent and continuous with a resistance of 3 ohm or less from raceway, cable tray, and equipment connections to the building grounding electrode or main electrical service entrance ground. The resistance across individual bonding connections shall be 10 milli ohms or less.

C. Bonding Jumpers:
1. Use insulated ground wire of the size and type shown on the Drawings or use a minimum of 16 mm² (6 AWG) insulated copper wire.

D. Coordination with Electrical Contractor
1. Contractor to provide all grounding components indicated in project documents.
2. General Contractor may selectively partition division of labor between Electrical Contractor and Low Voltage Contractor. Typically, the Electrical Contractor will provide all equipment outside of the Telecom Rooms, including the TBB and bonding to the main electrical service ground. The Low Voltage Contractor will typically provide all equipment within the telecom rooms. Without a GC to make this determination, contractor shall provide all equipment, wire, connections and labor as indicated on project documents.

3.02 SPLICES AND TERMINATION COMPONENTS

A. Use only HTAP crimp style splice connections when bonding one cable to another (same sized cables or different sized cables).
B. 14 ton electric, battery powered or manual crimping tools with appropriately sized dies for each splice connection.
C. Use crimp connections to 2-hole, double lug type connectors.

3.03 GROUNDING BUSBARS

A. Provide grounding busbars in every TR and MTR and Audio Visual equipment room. Provide grounding busbars in any other room dedicated to telecommunications equipment. If an entire room is not designated, but only a cabinet, provide busbar within or near cabinet.
   1. In TRs provide TGB sized at 12 inches x 4 inch mounted on insulated bushings.
   2. In MTR provide TMGB: 20 inches x 4 inch
   3. Double lug hole pattern only
   4. Tinned to resist corrosion
   5. In cabinets or on racks provide 19" wide busbar for local equipment grounding.
   6. Connect all metallic systems within a TR or MTR to the nearest TGB.
   7. Connect all TGBs to the TMGB by means of the TBB. See details.
   8. Connect the TMGB to the main electrical service entrance ground for the building.
   9. Connect TGBs to nearby building steel and/or the local electrical panel ground from which power to the TR is derived per J-STD-607-A if so indicated on details. Some jurisdictions do not desire this configuration but prefer only one connection at the main electrical service ground.
   10. If during a renovation access to the main electrical service ground is not possible or cost prohibitive, connections noted in item 9 above must be made. Obtain prior Engineer approval if access to the main electrical service ground is deemed impractical.
   11. Provide additional busbars or larger busbars as required to provide termination point for all bonding locations.
   12. Install busbars at 18" above finished floor unless noted otherwise on project documents.
   13. Install busbars at easily accessible, visible locations near data racks or entrance cables unless noted otherwise on project documents.

3.04 GROUNDING CONNECTIONS

A. General
   1. Provide lugs in each box and enclosure for equipment grounding conductor termination.
   2. Corrosion Inhibitors: When making ground and ground bonding connections, apply a corrosion inhibitor to all contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between the metals used.
   3. Above-Grade Grounding Connections: When making bolted or screwed connections to attach bonding jumpers, remove paint to expose the entire contact surface by grinding where necessary; thoroughly clean all connector, plate and other contact surfaces; and apply an appropriate corrosion inhibitor to all surfaces before joining.
   4. Assemble bonding jumpers using insulated ground wire terminated with compression connectors.
   5. Use compression connectors of proper size for conductors specified. Use connector manufacturer's compression tool.

B. Bonding Jumper Fasteners:
   1. Conduit: Fasten bonding jumpers using screw lugs on grounding bushings or conduit strut clamps, or the clamp pads on push-type conduit fasteners. When screw lug connection to a conduit strut clamp is not possible, fasten the plain end of a bonding jumper wire by slipping the plain end under the conduit strut clamp pad; tighten the clamp screw firmly. Where appropriate, use zinc-plated external tooth lock washers.
   2. Wireway and Cable Tray: Fasten bonding jumpers using zinc-plated bolts, external tooth lock washers, and nuts. Install protective cover, e.g., zinc-plated acorn nuts on any bolts extending into wireway or cable tray to prevent cable damage.
   3. Ground Plates and Busbars: Fasten bonding jumpers using two-hole compression lugs. Use tin-plated copper or copper alloy bolts, external tooth lock washers, and nuts.
   4. Unistrut and Raised Floor Stringers: Fasten bonding jumpers using zinc-plated, self-drill screws and external tooth lock washers.
   5. Always grind away paint and use antioxidant compound before making connections.

3.05 EQUIPMENT RACK AND CABINET GROUNDING BUSBARS

A. General
   1. Provide one grounding busbar at the bottom of every rack or cabinet.
   2. Bond to TGB with #6 copper conductor.

3. Do not daisy-chain between racks. Each rack should have its own conductor to the TGB. Or one conductor may be run from the farthest rack and others may splice to it using HTAP connectors.

3.06 GROUNDING TERMINAL BLOCKS

A. Provide as required in riser shafts and other areas not served by a TGB or standard data rack.

3.07 SPLICE CASE GROUNDING ACCESSORIES

A. Provide grounding bars, clamps, or other accessories as required in and near copper cable splice cases to maintain cable shield ground continuity from one side of splice to the other.
B. Provide same for fiber optic splices if metallic members are included in cable assembly.
C. Provide grounding bars, clamps or other accessories as required within handholes and manholes if provided by this project. This may include provision additional ground rods if not near a facility with metallic conduit or access to a TGB.

3.08 LABELS

A. Label all bonding conductors at TGB and TMGB with approved label.
B. In addition to any pre-printed information on label, add the following:
   1. Date of installation
   2. Far end termination location or system
   3. Example: "To Cable Tray", "To Runway", "To Data Racks", "To Main Electrical Service Panel".

3.09 COMMUNICATIONS CABLE GROUNDING

A. Bond all metallic cable sheaths in multipair communications cables together at each splicing and/or terminating location to provide 100 percent metallic sheath continuity throughout the communications distribution system.
B. At terminal points, install a cable shield bonding connector; provide a screw stud connection for ground wire. Use a bonding jumper to connect the cable shield connector to an appropriate ground source like the rack or cabinet ground bar.
C. Bond all metallic cable shields together within splice closures using cable shield bonding connectors or the splice case grounding and bonding accessories provided by the splice case manufacturer. When an external ground connection is provided as part of splice closure, connect to an approved ground source and all other metallic components and equipment at that location.

3.10 COMMUNICATIONS CABLE TRAY SYSTEMS

A. Bond the metallic structures of one cable tray in each tray run following the same path to provide 100 percent electrical continuity throughout the cable tray systems as follows:
B. Splice plates provided by the cable tray manufacturer can be used for providing a ground bonding connection between cable tray sections when the resistance across a bolted connection is 10 milliohms or less. The Subcontractor shall verify this loss by testing across one slice plate connection in the presence of the Contractor.
C. Install a 16 mm² (6 AWG) bonding jumper across each cable tray splice or junction where splice plates cannot be used.
D. When cable tray terminations to cable rack, install 16 mm² (6 AWG) bonding jumper between cable tray and cable rank pan.

3.11 COMMUNICATIONS RACEWAY GROUNDING

A. Conduit: Use insulated 16 mm² (6 AWG) bonding jumpers to ground metallic conduit at each end and to bond at all intermediate metallic enclosures.
B. Wireway: use insulated 16 mm² (6 AWG) bonding jumpers to ground or bond metallic wireway at each end at all intermediate metallic enclosures and across all section junctions.
C. Cable Tray Systems: Use insulated 16 mm² (6 AWG) bonding jumpers to ground cable tray to column-mounted building ground plates (pads) at each end and approximately every 16 meters (50 feet).

3.12 GROUND RESISTANCE

A. Grounding system resistance to ground shall not exceed 3 ohms. Make necessary modifications or additions to the grounding electrode system for compliance without additional cost to the Government. Final tests shall assure that this requirement is met.

B. Resistance of the grounding electrode system shall be measured using a four-terminal fall-of-potential method as defined in IEEE 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

END OF SECTION

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SECTION 27 05 53
IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Furnish, and install all materials and equipment and provide all labels required as shown on the Drawings, Schedules and as specified.
B. It is the intent of the Specifications, Drawings and Schedules that all labels will be machine based labels which are legible and provided in locations which are readily visible.
C. Only those items affected by the installation of the Project shall be labeled unless otherwise indicated.
D. Labeling includes all riser cables, horizontal cables, faceplates, patch panels, cabinets, wall fields, grounding/bonding conductors and bus bars.

1.02 SECTION INCLUDES

A. Termination Hardware and Cable Labels

1.03 RELATED WORK

A. Section 27 05 00 - Common Work Results for Communications Systems
B. All references including Division 26 apply
C. The work in this section is subject to requirements of the Contract Documents including General Conditions, Supplementary Conditions and sections under Division 1, General Requirements.

1.04 SUBMITTALS

A. Submit product data as required herein under provisions of Section 27 05 00 - Common Work Results for Communications Systems.
B. Submit product data for the following:
   1. Manufacturer and model of labeling device.
   2. Proposed method of jack labeling, including nomenclature and syntax.
C. Submit shop drawings for equipment under each section per requirements listed in that section, as well as per Division 1.
D. Submittals shall be grouped with related systems
E. Submit catalog sheets or photocopies. Do not submit hard copies of web pages. Web pages change frequently and will be rejected.
F. Circle noted item with black pen or use arrows that can be copied.
G. At end of project submit record documents, as-builts, certificates, warranties and other operational manual documents to assist owner to maintain all systems.
H. Work shall not proceed without Engineer's approval of submitted items. Materials that are installed without Engineer approval risk forced removal by contractor at Engineer request.
I. Shop Drawings shall contain sufficient information, clearly presented, to determine compliance with drawings, specifications and design intent. Include additional information and products that may be required to provide a complete, functioning system even if those items are not specifically listed in the project documents.

1.05 WORK INCLUDES

A. A complete, integrated, organized, intuitive labeling system for all communications cables and equipment.
B. Labels using black ink on white paper, printed plastic or engraved tags.
C. Labeling for riser cables, horizontal station cables, faceplates, patch panels, cabinets, wall fields, grounding/bonding conductors and bus bars.
D. Accurate as-built documentation in AutoCAD format that matches one-to-one the labels provided in the field.

1.06 STANDARDS AND CODES

A. Work shall be installed in accordance with national and state laws, ordinances, and regulations. All applicable OSHA regulations shall be complied with.
B. Unless otherwise noted, all labels at distribution frames shall follow the color coding scheme identified by the owner.

1.07 DIMENSIONS AND DEFINITE LOCATIONS

A. Unless otherwise indicated, the exact location of labels shall be established in the field in accordance with instructions from the Owner. Consideration shall be given to construction features, label placement as affected by Work by other Trades, and label placement to provide maximum benefit and minimum obstruction of physical equipment and hardware features.
B. The Owner shall provide information regarding the labels for the optical fiber enclosures. Do not use the manufacturer's supplies placards.

1.08 DRAWINGS AND SPECIFICATIONS

A. The Contractor shall keep a detailed up-to-date record of the label information and placement of all labels installed as specified herein.
B. The Contractor shall fill-in the label information on the forms or data documents provided by the Owner. The information requested is typically that which can only be provided after installation.

1.09 SUBSTITUTIONS

A. No substitutions shall be allowed unless specified.

1.10 CLEANING

A. The Contractor shall clean all surfaces prior to the attachment of labels. Follow the manufacturer's recommendations for cleaning.
B. The Contractor shall follow the manufacturer's recommendations for affixing labels.

PART 2 – PRODUCTS

2.01 TERMINATION HARDWARE AND CABLE LABELS

A. Acceptable Manufacturers of Labeling Machine:
   1. Panduit
   2. Brady
   3. Silver Fox
   4. System manufactured for or by the proposed structure cabling system
B. Acceptable Methods:
   1. Black letters on white paper
   2. Machine produced, not hand written
   3. Arial or block font
   4. Black letters printed on light colored plastic
   5. Labels as part of a manufacturer's system or product
   6. Engraved plastic or metallic tags
   7. Black letters on reflective yellow, sticky-backed products sometimes used for telco applications to label large cables, splices, wall fields and pedestals.
   8. Permanent

PART 3 – EXECUTION

3.01 SPACES

A. Item: Telecommunications Room (TR):
   1. Provide label on plywood near ICM system patch panels indicating room number.
   2. Large black letters on reflective yellow, sticky-backed label.

3.02 CABLING

A. Multi-Pair Copper Backbone Cabling
   1. Item: Telephone Backbone Riser Cabling
      a. Label Location: On the cable at both ends, near the hardware on which the cable is terminated. Also place label on cable within every accessible riser shaft space on every floor.
      b. Label Information: See copper cable and equipment specification
      c. Method: Printed label, permanently attached.
      d. Format: All capital letters. Font should be as large as possible to fill the label space with the information. The font should be Helvetica or equal and bold. Two line format with the cable number on the top line and the cable count below. Center the text and use a dash as delimiter.
      e. Example: See copper cable and equipment specification

B. Optical Fiber Backbone Cabling
   1. Item: Optical Fiber Backbone Cabling
      a. Label Location: On the jacket or sheath of the cable at both ends (before the fan-out or breakout point). Place the label near the cable entrance into the termination hardware and exterior to the termination hardware. Also place label on cable within every accessible riser shaft space on every floor.
      b. Label Information: See fiber cable and equipment specification
      c. Method: Machine printed Brady Labels, permanently attached.
      d. Format: All capital letters. Font should be as large as possible to fill the label space with the information. The font should be Helvetica or equal and bold. Two line format with the cable number on the top line and the cable count below. Center the text and use a dash as delimiter.
      e. Example: See fiber cable and equipment specification

3.03 TERMINATION HARDWARE

A. See design/construction documents for example of wall field layout and labeling.
   1. Copper Termination Hardware

B. Item: SIO faceplate
   1. Label Location: On the top of the faceplate in the outlet location window and behind the clear plastic window.
   2. Label Information: See copper cable specification
   3. Method: Manufacturer's white paper inserts. Print the information on an adhesive label and affix the label to the paper insert. Labels shall not be affixed to the clear plastic window. Install icon representing service at that jack position as defined by the cable records.
      a. Machine printed Brady Labels.
      b. Brady label part number:
   4. Format: Font should be sized to fill the area of the strip. The font should be Helvetica or equal and bold. Use one-line format.
   5. Example: See copper cable specification

C. Fiber Termination Hardware
   1. Item: Fiber Patch Panel Enclosures
   2. Label Location: On face of patch panel
   3. Label Information: See Fiber Optic Cable specification
   4. Method: Machine printed Brady Labels.
   5. Format: The font should be Helvetica or equal and bold.
   6. Example: See Fiber Optic Cable specification

D. Fiber Terminations
   1. Item: Optical fiber terminations
      a. The connector type and layout within each enclosure may vary. See Owner for specific connectors needed for this project and refer to the construction documents.
      b. Label Location: On front of patch panel above fiber port
      c. Label Information: See Fiber Optic Cable specification
      d. Method: Machine printed Brady Labels.
      e. Format: See Fiber Optic Cable specification

3.04 EQUIPMENT AND EQUIPMENT RACKS

A. Item: Equipment Racks
   1. The equipment racks are typically 19" free-standing or wall-mounted relay racks, floor mounted cabinets or wall mounted cabinets.
   2. Label Location: On front surface above door
   3. Method: Machine printed Brady Labels
   4. Format: Large font, black letters on white background, indicate cabinet number
   5. Example: CABINET #1, CABINET #2, etc.

3.05 LABEL FORMAT

A. Faceplates
   1. Unless noted otherwise labels
      a. Shall include telecom room number
      b. Shall be numbered sequentially for each telecom room. Numbers may start over for each telecom room
      c. Make no distinction between voice or data since all use the same cable and same outlet
         1) This may very depending on requirements of section 27 10 00 and if voice cable is terminated on a wall block rather than in a patch panel
      d. Do not need to contain room number where outlet is located. Rooms numbers may (often) change, rendering label inaccurate. Usually the telecom room plus a simple sequential number is sufficient so long as the outlet and patch panel labels match.

3.06 GROUNDING AND BONDING

A. See grounding details on drawings for labeling procedures.

END OF SECTION

SECTION 27 05 60
FIRESTOPPING FOR COMMUNICATIONS

PART 1 - GENERAL

1.01 SECTION INCLUDES
A. Firestopping of through Penetrations in Fire Rated Assemblies
B. Smoke Seals
C. Construction Enclosing Compartmentalized Areas

1.02 RELATED WORK
A. Section 03 30 00 – Cast-In-Place Concrete
A. Section 04 20 00 – Concrete Unit Masonry
B. Section 07 84 00 – Penetration Firestopping
C. Section 09 23 00 – Plaster and Gypsum Board
D. Section 26 05 00 – Electrical
E. Section 27 05 00 - Common Work Results for Communications Systems

1.03 SUBMITTALS
A. Submit under provisions of Section 01.
B. Product Data: Provide manufacturer's standard catalog data for specified products demonstrating compliance with referenced standards and listing numbers of systems in which each product is to be used.
C. Shop Drawings: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance ratings.
D. Certificates: Product certificates signed by firestop system manufacturer certifying material compliance with applicable code and specified performance characteristics.
E. Installation Instructions: Submit manufacturer's printed installation instructions.

1.04 REFERENCE STANDARDS
A. ASTM E 84 Surface Burning Characteristics of Building Materials
B. ASTM E 119 Fire Tests of Building Construction and Materials
C. ASTM E 814 Fire Tests of Through Penetration Firestops
D. ANSI/UL263 Fire Tests of Building Construction and Materials
E. ANSI/UL723 Surface Burning Characteristics of Building Materials
F. ANSI/UL1479 Fire Tests of Through Penetration Firestops
G. Underwriters Laboratories Inc. (UL) Fire Resistance Directory
H. National Fire Protection Association (NFPA) NFPA 101: Life Safety Code.
I. National Fire Protection Association (NFPA) NFPA 70: National Electrical Code.

1.05 QUALITY ASSURANCE
A. Products/Systems: Provide firestopping systems that comply with the following requirements:
   1. Firestopping tests are performed by a qualified, testing and inspection agency. A qualified testing and inspection agency is UL, or another agency performing testing and follow-up inspection services for firestop system acceptable to authorities having jurisdiction.
   2. Firestopping products bear the classification marking of qualified testing and inspection agency.
   3. Installer Qualifications: Experience in performing work of this section who is qualified by the firestopping manufacturer as having been provided the necessary training to install firestop products in accordance with specified requirements.

1.06 DELIVERY, STORAGE AND HANDLING
A. Delivery:
   1. Manufacturer's original, unopened, undamaged containers, identification labels intact identifying product and manufacturer, date of manufacture; lot number; shelf life, if applicable; qualified

testing and inspection agency's classification marking; and mixing instruction for multi-component products.
2. Handle and store products according to manufacturer's recommendations published in technical materials. Leave products wrapped or otherwise protected and under clean and dry storage conditions until required for installation.

B. Storage and Protection:
1. Store materials protected from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.

1.07 PERFORMANCE REQUIREMENTS

A. Fire rated pathway devices shall be the preferred product and shall be installed in all locations where frequent cable moves, add-ons and changes will occur.
B. Where non- mechanical products are utilized, provide products that upon curing do no re-emulsify, dissolve, leach, breakdown or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water or other forms of moisture characteristic during or after construction.
C. Where it is not practical to use a mechanical device, openings within floors and walls designed to accommodate telecommunications and data cabling shall be provided with re-enterable products that do not cure or dry.
D. Openings for cable trays shall be sealed using re-enterable firestopping pillows.
E. Only UL listed, approved or certified systems shall be installed.

1.08 PROJECT CONDITIONS

A. Do not install firestopping products when ambient or substrate temperatures are outside limitations recommended by manufacturer.
B. Do not install firestopping products when substrates are wet due to rain, frost, condensation, or other causes.
C. Maintain minimum temperature before, during, and for a minimum 3 days after installation of materials.
D. Do not use materials that contain flammable solvents.
E. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.
F. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.
G. Schedule installation of firestopping after completion of penetrating item installation but prior to covering or concealing of openings.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer: Specified Technologies Inc., 200 Evans Way, Somerville, NJ 08876. Tel: (800) 992-1180, Fax: (908) 526-9623, Email: specseal@stifirestop.com, Website: www.stifirestop.com.
B. Substitutions: HILTI
C. Single Source: Obtain firestop systems for each type of penetration and construction condition indicated only from a single manufacturer.

2.02 MATERIALS

A. General: Use only firestopping products that have been tested for specific fire resistance rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire rating involved for each separate instance.
B. Firestop Sealants: STI SpecSeal® Brand single component latex formulations that upon cure do not re-emulsify during exposure to moisture, the following products are acceptable:
1. Specified Technologies Inc. (STI) SpecSeal® Series SSS Sealant
2. Specified Technologies Inc. (STI) SpecSeal® Series LCI Sealant

C. Firestop Putty: STI SpecSeal® Brand intumescent, non-hardening, water resistant putties containing no solvents, inorganic fibers or silicone compounds, the following products are acceptable:
   1. Specified Technologies Inc. (STI) SpecSeal® Series SSP Putty
D. Firestop Pillows: STI SpecSeal® Brand re-enterable, non-curing, mineral fiber core encapsulated on six sides with intumescent coating contained in a flame retardant poly bag, the following products are acceptable:
   1. Specified Technologies Inc. (STI) SpecSeal® Series SSB Pillows
E. Fire Rated Cable Pathways: STI EZ-PATH™ Brand device modules comprised of steel raceway with intumescent foam pads allowing 0 to 100 percent cable fill, the following products are acceptable:
   1. Specified Technologies Inc. (STI) EZ-PATH™ Fire Rated Pathway
   2. Use EZ path system for all 4" sleeve openings from Telecom Rooms to hallways.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Before beginning installation, verify that substrate conditions previously installed under other sections are acceptable for installation of firestopping in accordance with manufacturer's installation instructions and technical information.
B. Surfaces shall be free of dirt, grease, oil, scale, laitance, rust, release agents, water repellants, and any other substances that may inhibit optimum adhesion.
C. Provide masking and temporary covering to protect adjacent surfaces.
D. Do not proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General: Install through-penetration firestop systems in accordance with Performance Criteria and in accordance with the conditions of testing and classification as specified in the published design.
B. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of firestopping products.

3.03 FIELD QUALITY CONTROL

A. Inspections: Owner shall engage qualified independent inspection agency to inspect through-penetration firestop systems.
B. Keep areas of work accessible until inspection by authorities having jurisdiction.
C. Where deficiencies are found, repair firestopping products so they comply with requirements.

3.04 ADJUSTING AND CLEANING

A. Remove equipment, materials, and debris, leaving area in undamaged, clean condition.
B. Clean surfaces adjacent to sealed openings to be free of excess firestopping materials and soiling as work progresses.

3.05 SCHEDULES

	Concrete Floor	Concrete Wall	Gypsum Board Wall
Penetrant Type			
Blank Opening	C-AJ-0100, C-AJ-0101	C-AJ-0100, C-AJ-101	
Metal Conduits	C-AJ-1080, C-AJ-1240, C-AJ-1353	C-AJ-1080, W-J-1098, W-J-1100	W-L-1049, W-L-1222, W-L-1168
Plastic Conduits/ Raceways	C-AJ-2140, C-AJ-2292	W-J-2018, W-J-2076	W-L-2093, W-L-2241
Cables	C-AJ-3214, C-AJ-3231, F-A-3015	C-AJ-3214, C-AJ-3231, W-J-3098, W-J-3099	W-L-3218, W-L-3219
Cable Trays	C-AJ-4029	W-J-4021, W-J-4022, W-J-4033	W-L-4008, W-L-4029, W-L-4043

END OF SECTION

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SECTION 27 11 00
COMMUNICATION ROOM PROVISIONING

PART 1 – GENERAL

1.01 SECTION INCLUDES
A. Free Standing 2-Post Racks
B. Cable Management
C. Flexible Nonmetallic Innerduct
D. Cable Runway
E. Miscellaneous Equipment

1.02 RELATED WORK
A. Section 27 05 00 - Common Work Results for Communications Systems
B. All references including Division 26 apply.
C. The Work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and sections under Division 1 General Requirements.

1.03 SUBMITTALS
A. Submit product data indicating construction, materials, ratings and all other parameters.
B. Submittals shall be grouped to include complete documentation of related systems, products and accessories in a single submittal. If provided electronically in PDF format, one Specification Section should equal one file or file name. Do not scan multiple Specification Sections into one file.
C. Where applicable, dimensions shall be marked in units to match those specified.
D. Submittals shall be original catalog sheets or photocopies thereof. Facsimile (fax) sheets, web pages and supplier/distributor information will not be accepted.
E. Where more than one product appears on a page, circle or clearly mark products submitted with black ink (not high-lighted).
F. Submit manufacturer's installation instructions

1.04 REFERENCE STANDARDS
A. BICSI TDMM — Telecommunications Distribution Methods Manual.
B. TIA/EIA 568-B.1-B.3 — Commercial Building Telecommunications Cabling Standard.
C. TIA/EIA 569-B — Commercial Building Standard for Telecommunications Pathways and Spaces.
D. TIA/EIA 606 — The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.
E. TIA/EIA 607 — Commercial Building Grounding and Bonding Requirements for Telecommunications.
F. UL 910 — Test for Flame Propagation and Smoke-Density Values for Electrical and Optical-Fiber Cables used in Spaces Transporting Environmental Air.
G. UL 1660 — Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts.
H. NFPA 70 — National Electric Code 2011.

1.05 DESCRIPTION
A. Provide complete telecommunication room (TR) fit out including all racks, cabinets, overhead runway, innerduct, busbars, grounding and bonding, wall mounted equipment and cable management.

PART 2 – PRODUCTS

2.01 FREE STANDING 2-POST RACKS
A. Manufacturers: Damac, Rittal, Great Lakes, Chatsworth, Hubbell, Panduit or product manufactured by the selected cabling system.

B. General:
   1. Equipment racks shall be:
      a. Constructed of painted (black) or anodized steel or aluminum.
      b. Supplied with ground bar (19" wide by 1" high) and #6 AWG ground lugs.
      c. Supplied with minimum of 12 releasable cable support ties (e.g. "hook and loop").
      d. Supplied with spare screws (minimum of 50)
   2. Channel uprights shall be spaced to accommodate industry standard 19" mounting.
      a. 2-Post floor mount racks
      b. Standard 2-post rack with 19" mounting space, painted black, bolted to floor at bottom and to wall at top.
      c. 7 ft. (84") tall rack, 45 rack units (RU). EIA/TIA tapped holes both sides, alternating pattern
      d. High strength extruded aluminum
      e. 1000 lb. capacity

2.02 CABLE MANAGEMENT

A. Vertical and Horizontal cable managers
   1. Manufacturers: Chatsworth, Hubbell, B-Line, Panduit or product manufactured by the selected cabling system (Commscope/Systimax).
   2. Material: metallic construction, painted to match cabinets and patch panels (black)
   3. 8" or 10" vertical cable managers, full-length, accessible from both sides, having "fingers" both front and rear.
   4. 1 or 2 RU horizontal cable managers between every UTP patch panel as indicated on project documents.

2.03 FLEXIBLE NONMETALLIC INNERDUCT AND FITTINGS

A. Manufacturers: Carlon, Pyramid, Duraline
B. General:
   1. Flexible Nonmetallic Innerduct shall be used:
      a. As protection to standard fiber optic cables when installed in cable tray
      b. As protection to fiber optic cables within TRs.
   2. Flexible Nonmetallic Innerduct shall be 1-1/4" diameter unless noted otherwise.
   3. This product is NOT REQUIRED if selected fiber optic cable has an armored sheath.
C. Indoor Innerduct:
   1. Shall be corrugated
   2. Non-plenum to be orange colored
D. Outdoor Innerduct shall be:
   1. Smooth outside and ribbed inside
   2. Rated for outdoor use
   3. Be Orange colored
E. Plenum Rated Innerduct shall:
   1. Be fabricated of flame-retardant materials suitable for installation in plenum rated environments.
      a. Meet requirements for flame propagation for listed optical fiber cables installed in spaces transporting environmental air.
   2. Be White colored.
F. Flexible Fabric Innerduct:
   1. Flexible Fabric Innerduct (FFI) shall be used as follows:
      a. To segment conduit(s), increasing their capacity for fiber optic and copper cable backbone runs within conduit.
      b. Use 3-4 inch, 3 cell product with pull strings.
      c. Manufacturer: MacCell

2.04 CABLE RUNWAY

A. Manufacturers: CPI, B-Line, Homaco or product manufactured by the selected cabling system (Commscope/Systimax).
B. Cable Runway shall be:

1. Constructed of 0.065" thick steel
2. Utilize tubular stringers to support rungs.
   a. Stringers shall be 1-1/2" high.
   b. Rungs shall be welded to stringers and shall be spaced 9" on center.
3. Width(s) as shown on drawings.
4. Painted with black epoxy to match cabinets.
5. Cabinets, free standing racks and cable runway shall all be of the same color

C. Cable Runway Accessories as recommended by manufacturer (to include, but not limited to):
1. Butt Splice Kit
2. Junction Splice Kit
3. Channel Rack-to-Runway Mounting Plate
4. Triangular Support Bracket, Steel
5. Wall Angle Support Kit, Cable Runway
6. Foot Kit, Cable Runway
7. Vertical Wall Brackets

2.05 MISCELLANEOUS MATERIALS

A. Telecommunications Ground Busbar (TGB)
1. Manufacturers: CPI, Harger, B-Line
2. Be wall mounted
3. Pre-drilled with double-hole lug pattern
4. See project documents for details and sizes

B. Power Devices
1. Power Strips
   a. Provide one eight (8) outlet horizontal power strip for each rack
2. Uninterruptible Power Supplies (UPS)
   a. Provided by owner unless noted otherwise on project documents

C. Plywood
1. Plywood shall be provided by the EC if not already provided by the General Prime Contractor (GPC). The EC shall coordinate this requirement prior to bidding to determine installation responsibility.
2. General
   a. Provide plywood on all walls wider than 12”
   b. ¾” x4’x8’, standard plywood sheet size
   c. Fire retardant treatment with verifying stamps
   d. Grade A/C with A side mounted out, smooth finish, no splinters, dimples or open knots, no texture
   e. No internal or external voids
   f. Flat, not warped
   g. Placed on 1.5” thick furring strips or 1.5” hat channel if mounted on concrete or CMU (so screws don’t dead-end behind plywood when mounting equipment)
   h. Aligned with studs if studs are present. Each edge of plywood shall be on a stud. Split studs at seams.
   i. Mounted vertically, may start at 2” or 4” above floor to account for baseboard or to assist leveling. Does not want to be tight to floor (catches dirt and debris, floor is not always level or smooth)
   j. All seams flush with each other on all surfaces, no warps, no uneven surfaces, no uneven edges at top, sides or bottom
   k. Ceramic coated or stainless steel screws to resist corrosion and chemical interaction with firestop treatment of plywood
   l. Screws to be minimum #12 size, wood screw threads, minimum 2” long, flat head, heavy-duty, Philips, Torx or square drive
   m. Even pattern 16” O.C. horizontally and 24” O.C. vertically including all corners. (20) screws minimum every 4x8 sheet. Provide additional screws as required to counteract warping and to assure flush surfaces all around.
   n. All screws to be set flush to plywood surface

o. Painted light (white, not gray) color, leave one fire stamp visible on every sheet
p. Mounted and painted prior to mounting of electrical equipment

PART 3 - EXECUTION

3.01 FREE STANDING 2-POST RACKS

A. Provide equipment racks as shown on drawings.
B. Racks shall be secured as recommended by manufacturer and braced with cable runway as shown on drawings. Bolt 2-post racks to floor using (4) bolts. Also secure top of 2-post racks to adjoining wall using short section of cable runway and appropriate rack to runway mounting kits, j-bolts and wall angle supports.
C. Provide Horizontal and Vertical Cable Management on, one vertical manager for each side and three (2) 2-RU horizontal mangers for each rack.
D. Provide ground bar in equipment racks and cabinets.
E. Bond rack mounted ground bar to telecommunications room ground bar.
   1. Racks and cabinets shall have individual grounding conductors from each rack bonded to TGB
   2. Daisy-chaining grounding conductors between racks or cabinets is not allowed
F. Coordinate with General Contractor for provision of ¾" fire retardant plywood on all walls.
G. Coordinate with Electrical Contractor for provision of power.
H. Coordinate with Electrical contractor for division of labor installing the grounding and bonding system. This contractor is responsible for all grounding and bonding of all telecom equipment within the TR.

3.02 CABLE MANAGEMENT

A. Cable management must be planned carefully to avoid unnecessary cable crossovers and intertwining. Use Velcro style cable tie wraps at 24 inch intervals in TRs, on wall fields and in cable trays with TRs.
B. Vertical cable managers – provide one full-length cable manager on both sides of rack.

3.03 FLEXIBLE NONMETALLIC INNERDUCT AND FITTINGS

A. Innerduct shall extend to equipment racks at system endpoints.
B. Where not installed in continuous length, splice innerduct segments using couplings designed for that purpose.
C. Provide quick connect adapters on end of innerduct where innerduct contacts junction boxes or fiber optic patch panels.
D. Empty innerduct shall be equipped with pull cord and capped at both ends.
E. Provide Plenum-rated innerduct under all raised floors and in ceiling plenums.
F. Label innerduct at 35 ft. intervals in ceilings with tags indicating cable type and cables contained therein.
G. Label innerduct on every floor in every riser shaft at eye level according to fiber type, fiber count, destination at both ends and installation date. Example: 12 MM/Floor 1 MTR to Floor 2 TR, 10/25/2012.
H. Pull strings shall extend beyond end of innerduct and be tied off securely for access.
I. Label each end of pull string with distinguishing label for each innerduct so that one end can be traced to the other. Simple numbering or lettering is sufficient.
J. Fasten innerduct raceway to building structure at 4-6 foot intervals in ceiling to prevent movement and shifting of innerduct during cable installation.
K. Provide innerduct for fiber optic cables passing between floors from one TR to the next.
L. For all 4" conduits provided for communications cables, but not currently used for cable installation, provide (2) 3-cell FFI products (6 pathways) from end to end for future cable installations.

3.04 CABLE RUNWAY

A. Provide runway and accessories necessary for complete system.
B. Size and layout of runway shown on drawings.
C. Install runway and accessories per manufacturers' installation instructions.
   1. Use only runway accessories manufactured and recommended by runway manufacturer

2. No custom-built brackets or devices allowed

D. Provide 3/8" threaded rods for support of 12" wide or smaller runway as required for ceiling mount.
E. Provide 1/2" threaded rods for support of runway greater than 12" in width.
F. Support from building structure.
G. When runway is installed on (adjacent to) walls, use triangular support brackets, not threaded rod.
H. Maximum allowable deviation of runway from level horizontal plane measured across length of tray shall be 1/2", with the tray loaded to capacity.
I. Fasten runway to top of equipment racks within TRs with equipment manufactured for this purpose.
J. Use 3" spacers on top of racks to mount cable runway. Nominal height of cable runaway above floor with use of spacers will be 7'-3". Be sure runway clears all door swings.
K. Provide cable dropouts at all equipment rack locations, elevation changes 6" or more, and as shown on drawings.
L. Bond runway components together using manufacturer's standard accessories. Grind off paint as required to obtain positive electrical connection, or use washers manufactured for that purpose. Bond runway to TGB.
M. Fasten cables to runway within TRs at intervals not to exceed 4 ft.

3.05 MISCELLANEOUS EQUIPMENT

A. Provide TGB in every TR as indicated.
   1. Mount at 18” AFF
   2. Coordinate with electrical contractor as required.
B. Cable Management Straps
   1. Cables shall be secured with reusable hook and loop straps.
   2. Provide Cable Management on 2-post racks
   3. Provide cable management both vertically and horizontally on racks as indicated on project documents.
C. Provide extra heavy cable tie mounts on TR plywood and riser walls at 24 inch intervals to support cable. Must utilize #8 or #10 screws – NOT ADHESIVE. Similar to Panduit TMEH-S10-Q0. Other brands: HRP, Uline.

END OF SECTION

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SECTION 27 13 10
BACKBONE COPPER CABLE AND EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES
A. Communications Cables
B. Copper Backbone Cable
C. Cable Terminations
D. Backbone Coax Cable
E. Cable Identification

1.02 RELATED WORK
A. Section 27 05 00 - Common Work Results for Communications Systems
B. All references including Division 26 apply.
C. The work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and sections under Division 1 General Requirements. This work is also subject to all requirements of Division 26 of these specifications wherever applicable to work under this section.

1.03 SUBMITTALS
A. Submit shop drawings for equipment under this section.
B. Submittals should be grouped to include complete documentation of related systems, products and accessories in a single submittal. If provided electronically in PDF format, one Specification Section should equal one file or file name. Do not scan multiple Specification Sections into one file.
C. Where applicable, dimensions shall be marked in units to match those specified.
D. Submittals shall be original catalog sheets or photocopies thereof. Facsimile (fax) sheets or printed web pages shall not be accepted. Circle appropriate part number with black pen. Circle appropriate picture if more than one appears on page. Contractor shall indicate on submittal the system(s) served by each cable submitted.
E. Submit manufacturer's installation instructions.
F. Submit one 2-foot section of each cable type from cable reels sent to the site for Engineer's final approval. This two-foot section shall have manufacturer's cable markings visible.
G. Work shall not proceed without Engineer's approval of submitted items.

1.04 REFERENCE STANDARDS
A. Installation requirements are found in the following the American National Standards Institute (ANSI) and Electronic Industries Association/ Telecommunications Industry Association (EIA/TIA) Standards.

B.	ANSI/TIA/EIA-568-B	Commercial Building Telecommunications Cabling Standard
C.	ANSI/EIA/TIA-569-B-2004	Commercial Building Standard for Telecommunications Pathways and Spaces
D.	ANSI/TIA/EIA-606-A-2002	Administration Standard for the Telecommunications Infrastructure of Commercial Buildings

1.05 QUALITY ASSURANCE
A. Full compliance with engineered design and specifications is required.
B. Performance criteria specified in references cited in Paragraph 3.02 shall be met. Test data shall verify system performance.

1.06 PERFORMANCE TESTING
A. Testing of all installed cable and equipment shall be performed by the contractor as soon as practical after equipment is installed.
B. Contractor shall use current, state-of-the-art, industry standard test equipment.

C. Testing shall be accomplished before notifying Engineer of substantial completion and before punch list is performed.

1.07 WORK BY OWNER

A. Owner may elect to provide cross connections from Contractor provided cable systems to owner provided equipment such as telephone or data systems.
B. The Local Exchange Carrier may provide certain cross connections to LEC owned equipment.
C. The above two conditions may be presumed applicable during bidding unless project documents indicate otherwise.

1.08 WORK INCLUDES

A. Complete backbone copper cable system utilizing standard telephone cable equipment. Work covered by this Section shall consist of furnishing labor, equipment, supplies, materials, and testing unless otherwise specified, and in performing the following operations recognized as necessary for the installation, termination, and labeling of copper backbone infrastructure as described on the Drawings and/or required by these specifications.

1.09 DESCRIPTION

A. This Section includes specifications for 100 ohm balanced twisted pair copper backbone cable and connections as typically used in telephone systems.

1.10 CODE COMPLIANCE

A. All work and materials shall comply with the most recent rules, codes, and regulations, including but not limited to the following.
   1. Occupational Safety and Health Act Standards (OSHA)
   2. NFPA 70 - National Electrical Code (NEC)
   3. ANSI/IEEE C-2 National Electrical Safety Code
   4. All other applicable Federal, State, and local laws and regulations.

1.11 MANUFACTURER'S INSTRUCTIONS

A. When specified in Specification Sections, submit manufacturer's printed instructions for delivery, storage, assembly, installation, adjusting, and finishing, in quantities specified for Shop Drawings and Equipment Brochures.
B. Unless otherwise stated, where installation requirements identified in Reference Standards conflict with the manufacturer's recommendations, the more restrictive shall be apply.
C. Bring to the attention of the Owner and HCIS conflicts between manufacturer's instructions and Contract Documents.

PART 2 - PRODUCTS

2.01 COMMUNICATIONS CABLES

A. Communications cables shall be type and size (number of pairs) identified for the installation of the various communications systems. Provide standard multi-pair, color coded, telephone cable.
B. Communications cables shall be Listed and Approved for intended use by a nationally recognized testing laboratory. All cable shall be of Type specified by the NEC for use in plenum, non-plenum, and riser spaces.
C. Communications cables installed in cable trays shall be APPROVED for use in such and shall be of fire-resistive construction.
D. Communications cable suitable for use in ducts, plenum, and other space used for environmental air shall be UL Listed as being smoke resistant, shall be Teflon-coated and shall be classified as type CMP communications cable.
E. Communications cable suitable for use in vertical shafts shall be UL Listed for use in such space and shall be classified as type CMR communications cable.

F. CM rated cables entering from outside the building must comply with the 50 foot rule. That is, cable must be terminated, protected or transitioned within 50 feet of the outdoor entrance or 50 feet from the emergence of approved conduit.
G. Approved conduit from outside the building consists of either rigid steel conduit or intermediate steel conduit. EMT does not qualify. Outdoor cable entering a building within EMT conduit must still comply with the 50 foot rule.

2.02 COPPER BACKBONE CABLE

A. Copper Telephone Backbone Cable for indoor application: Type CMR, 24 AWG twisted, solid annealed copper conductors insulated with PVC skin over expanded polyethylene, having an overlapped corrugated aluminum shield (ARMM Type), fire-resistant FR-PVC plastic jacket, conforms to Bell Laboratories specification L-780011 and ANSI/TIA/EIA 568-A, and Class 3 Category-3 performance category.
   1. Cable used in outdoor applications shall be rated for that application (AFMW type).
   2. Outdoor cable shall have gel filling or water block tape to prevent ingress of water.
   3. Cable used in pure riser applications shall be shielded **ARMM type** without blocking.
B. Acceptable Manufacturers: Commscope, Mohawk, General, Superior Essex Belden. Size as specified on the Drawings.
C. Copper backbone cable shall be rated for the environment in which installed.
D. Copper backbone cable shall be provided by the Communications Contractor.
E. Backbone cable shall meet following minimum requirements:

Size	24 AWG solid annealed copper pairs					
Number of Pairs	As shown on Project Documents					
Mutual Capacitance	≤ 6.6 nF/100m					
Impedance	100 ohms ± 15%					
Frequency (MHz)	0.772	1	4	8	10	16
Attenuation (dB/100m@20° C)	6.0	7.0	15	23	26	35
Worst Pair NEXT (dB)	43	42	34	32	31	28
Jacket Color	Black or Grey					
Jacket Type	PVC – ALVYN sheath					
Cable Rating	NEC Article 800 Type CMR, UL listed					
Shield	Overall, continuous corrugated aluminum bonded to outer jacket					

F. Cable shall be standard exchange type telephone cable. This is defined as paired multi-conductor, thermoplastic insulated, copper cable characterized by a mutual capacitance of 0.083 microfarads per mile at 1000 Hz.
G. Identify conductors by insulation color.
H. Color code shall follow industry standard of 10 distinctive colors to identify 25 pairs.
I. Marking of each mate of the primary conductor in pair with color of that primary conductor is optional.
J. When cables of larger than 25 pairs are required, cable core shall be assembled into 25-pair sub-units.
K. Cables with over 600 pairs shall have 25-pair binder groups combined into super units.
   1. Wrap super units with solid color thread that follows primary color scheme of white, red, black, yellow and violet.
   2. Maintain binder color code integrity whenever cables are spliced.

2.03 CABLE TERMINATIONS

A. Provide 110 style high density connection blocks with (IDC) connectors
B. Acceptable manufacturers: Commscope, Panduit, Siemens
   1. Cross connect blocks shall:
      a. Be designed to maintain cable pair twists as closely as possible to point of mechanical termination.
      b. Identify pair position by color designation.
         1) Colors shall be Blue, Orange, Green and Brown for Station Cables and Blue, Orange, Green, Brown and Slate for Backbone Voice Cables.
   2. Each horizontal row of cross connect blocks shall be capable of terminating one 25 pair binder group of Backbone Voice Cable, or six 4 pair Station Voice Cables.

2.04 BACKBONE COAXIAL CABLE

A. Intra-Building Riser
   1. .500 Backbone Cabling (half inch hard line)
   2. Basic Construction
      a. Center conductor: Copper-clad aluminum (0.109" nominal outer diameter).
      b. Dielectric: Gas injected foam polyethylene.
      c. Outer shield: Continuous, solid aluminum (0.500" nominal outer diameter, 0.024" nominal thickness)
      d. Jacket: Flame retardant polyethylene (0.560" nominal outer diameter, 0.030" nominal thickness)
         1) Jacket shall be free of pinholes, cracks and blisters.
         2) Jacket shall contain carbon black to ensure ultraviolet light stability (UV)
      e. Specifications:
         1) Impedance: 75 ± 2 ohms
         2) Capacitance: 15.3 ± 1.0 pf/ft.
         3) Velocity of Propagation: 87% nominal
         4) Minimum Structural Return Loss: -30 dB (5-1000 MHz)
         5) Maximum Attenuation @ 68°F: 0.54 dB/100 ft. (55 MHz)
         6) 16 dB/100 ft. (750 MHz)
         7) Cable Rating: Type CATVR

B. Riser and Distribution Coaxial Cable
   1. Manufacturers: CommScope, Belden.
   2. Cable shall be RG-11 type.
   3. Construction (RG-11 type, quad-shield):
      a. Center Conductor: 14 AWG copper-clad steel (0.064" nominal outer diameter).
      b. Dielectric: Gas expanded (foamed) polyethylene (0.280" nominal diameter).
      c. First shield: Aluminum-polypropylene-aluminum laminated tape with overlap bonded to dielectric.
      d. Second shield: 34 AWG aluminum braid wire (60% coverage).
      e. Third shield: Non-bonded foil shield.
      f. Fourth shield: 34 AWG aluminum braid wire (60% coverage)
      g. Jacket: Flame retardant PVC (0.405" nominal outer diameter). Jacket shall contain carbon black to ensure ultraviolet light stability (UV).
      h. Specifications:
         1) Impedance: 75 ± 3 ohms
         2) Velocity of Propagation: 87% nominal
         3) Maximum Attenuation @ 68°F: 0.96 dB/100 ft. (55 MHz)
         4) 65 dB/100 ft. (750 MHz)
         5) Cable Rating: Type CATVR

2.05 CABLE IDENTIFICATION

A. Cable labels
   1. Manufacturer: Brady, Panduit, Silver Fox or same as cable system manufacturer
   2. Type: adhesive or tie-wrap
   3. White background with black, bold, readable letters, machine printed
   4. Refer to section 27 05 53.

PART 3 - EXECUTION

3.01 CABLE INSTALLATION

A. Refer to project documents for cable routing.

B. When breaking out any multi-pair copper cable of 50 pairs or greater for splicing or termination, the binder groups shall have color coded cable ties attached to the cable at the point of fanout from super groups for splicing, and at the point of fan-out for termination on termination blocks.
C. Contractor shall ensure the cables are pulled into the ducts in a manner observing the bend radii and tension restrictions of the cable.
D. Contractor shall use appropriate shoes, guides, wheels and lubricants to prevent damage to the cable jacket and sheath during installation.
E. All pairs spliced shall be tested and all splice-related faults cleared prior to sealing the closure assembly if required.
F. Provide Backbone Voice Cable from MTR to TRs. Size cables as shown on Project Documents.
G. Terminate cables on backbone voice cable blocks at all TRs.
H. Cables shall have pair twists maintained to within 1" of termination.
I. Remove cable jacket only to extent required to make terminations.
J. Install shield bond connectors to the shields of all cables terminated at the Protector Panels or ground bars. Bond all cable shields to ground.
K. Bond all cable shields in Data Center, MTR or MDF to TMGB. Bond only at one end of shield at head end location. Affix label at far end of cable indicating bonding connection to ground has been made at MTR.
L. Provide RG11 or .500 hardline coax backbone cable from MDF or cable TV demarcation to telecom room(s). Coax to TV outlets may be RG6.
   1. RG11 may be used for lengths of 150 to 300 ft.
   2. Beyond 300 feet use .500 hardline.
   3. RG6 should not exceed 150 ft from telecom room to TV outlet

3.02 COMMUNICATIONS CABLING TESTING

A. Individually test all pairs and cable shields from both ends of the cable for continuity, power faults, and ground-faults. Correct all shorts, opens, crosses, bad terminations, foreign voltages, grounding problems, sheath continuity problems, etc.
B. In addition, provide loop resistance measurements in ohms and dB loss at 1 KHz and calculated dB loss at 8 KHz and 256 KHz on the first pair of each binder group.
C. Owner/engineer is to be notified at least 48 hours prior to testing to allow observation at Owner/engineer discretion. If the Owner/engineer confirms the intention to observe, a reasonable starting time will be agreed upon. Should the Owner/engineer not be present at the scheduled commencement time, the Contractor may begin testing as scheduled.

3.03 WIRE AND CABLE IDENTIFICATION

A. Cable sheath
B. Cable sheath shall be labeled approximately 12-24” from cable termination of wall field.
C. Label shall be on a plastic tag, which is tie-wrapped to cable sheath, or placed on adhesive labels, which are stuck to the cable sheath.
D. If adhesive labels are used, cable sheath shall be cleaned thoroughly before applying label. Afterwards, a clear cellophane tape covering should be placed over the label to protect it and maintain adhesion to sheath.
E. The label shall identify cable (CA) number, total number of pairs in cable, and date installed. The label shall also indicate the near and far end termination locations.
F. Example:

CA-1, 25 pair 1-50 MDF to TR 101 August, 2024

   a. Backbone Voice Riser Cable (from Main Telecom Room (MTR) to other TRs)
   b. Labeling shall meet all general requirements and the following:
   c. Designation strips on the 110 blocks shall be labeled in 25 pair groups indicating destination room number far end (including floor) and pair counts. The far end room number shall be repeated on every designation strip.
2. Backbone voice riser cable designation strips shall be labeled as follows:

a. TR XXX-YY where:

XXX = Far end room number
YY = Pair number

3. Example MTR to upper TR:

TR 201-01	0
TR 201-026	050

4. Example TR to Main TR:

MTR 106-01	025
MTR 106-026	050

5. Cable sheath
   a. Cable sheath shall be labeled approximately 24" from cable termination on wall field.
   b. Label shall be on a plastic tag, which is tie-wrapped to cable sheath, or placed on adhesive labels, which are stuck to the cable sheath.
   c. If adhesive labels are used, the cable sheath shall be cleaned thoroughly before applying the label. Afterwards, a clear cellophane tape covering should be placed over the label to protect it and maintain adhesion to sheath.
   b. Label shall identify cable from and to locations, total number of pairs in cable, and date installed.
6. Example MTR to TR:

MTR 106 to TR 3164 1-200 10/2024

7. Example TR to MTR:

TR 3164 to MTR 106 1-200 10/2024

END OF SECTION

SECTION 27 13 20
FIBER OPTIC CABLE AND EQUIPMENT

PART 1 – GENERAL

1.01 SECTION INCLUDES
A. Fiber Optic Cable
B. Fiber Optic Connectors
C. Fiber Optic Patch Panels
D. Miscellaneous Materials

1.02 RELATED WORK
A. Section 27 05 00 - Common Work Results for Communications Systems
B. All references including Division 26 apply.
C. The work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and sections under Division 1 General Requirements. This work is also subject to all requirements of Division 26 of these specifications wherever applicable to work under this section.

1.03 SUBMITTALS
A. Submit product data for equipment provided under this section.
B. Submittals should be grouped to include complete documentation of related systems, products and accessories in single submittal. If provided electronically in PDF format, one Specification Section should equal one file or file name. Do not scan multiple Specification Sections into one file.
C. Dimensions shall be marked in units to match those specified.
D. Submittals shall be original catalog sheets or photocopies thereof. Facsimile (fax) sheets or printed web pages shall not be accepted. Circle appropriate part number with black pen. Circle appropriate picture if more than one appears on page. Contractor shall indicate on submittal the system(s) served by each cable submitted.
E. Submit manufacturer's installation instructions.
F. Prior to completion of final fiber optic test results, submit sample test results or three fibers to engineer for review and approval. Failure to submit sample tests indicating sample results and formatting may be cause for rejection of test results

1.04 REFERENCE STANDARDS

A.	BICSI TDMM	Telecommunications Distributions Methods Manual (Current edition)
B.	TIA/EIA - 455-21-A	Mating Durability for Fiber Optic Interconnecting Devices
C.	TIA/EIA - 526 – 14	Optical Power Loss Measurements of Installed Multimode Fiber Cable Plants
D.	TIA/EIA 568-B.1-B.3	Commercial Building Telecommunications Cabling Standard
E.	TIA/EIA 569-B	Commercial Building Standard for Telecommunications Pathways and Spaces
F.	TIA/EIA 606	The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
G.	TIA/EIA 607	Commercial Building Grounding and Bonding Requirements for Telecommunications
H.	UL 910	Texts for Flame Propagation and Smoke-Density Values for Electrical and Optical-Fiber Cables used in Spaces Transporting Environmental Air
I.	UL-1666	Tests for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts

1.05 PERFORMANCE TESTING
A. Testing of all installed cable and equipment shall be performed by the contractor as soon as practical after equipment is installed.

B. All fibers shall be tested with state-of-the-art, industry standard test equipment by personnel properly trained to operate equipment.
C. Testing shall be accomplished before notifying Engineer of substantial completion and before punch list is performed.

1.06 WORK INCLUDES

A. All labor and materials for a complete fiber optic backbone cable system utilizing multimode fiber cables. Work covered by this Section shall consist of furnishing labor, equipment, supplies, materials, and testing unless otherwise specified, and in performing the following operations recognized as necessary for the installation, termination, and labeling of fiber optic infrastructure as described on the Drawings and/or required by these specifications.
B. Any part numbers provided in this specification are included for reference only or as an example of the type and quality of system to be installed. It shall be the contractor's responsibility to supply a system in excellent working order, which fully meets the criteria set forth in the general description as well as the listed specifications. It shall be the contractor's responsibility to verify the correctness of parts lists and specifications for use of equipment specified, in the manner specified, and for conditions as they actually exist on the job site. Equipment not mentioned herein or shown on the drawings but necessary to meet this requirement shall be provided and shall be so indicated in the initial Bill of Materials, or shop drawing submittals, or shall be provided without claim for additional payment.

PART 2 – PRODUCTS

2.01 FIBER OPTIC CABLE

A. Manufacturers: CommScope/SYSTIMAX, Corning, Belden, OFS or approved equal.
B. Multimode fiber shall be: 50-micron laser optimized, OM3, plenum rated fiber optic cable.
C. Optical fibers shall:
   1. Be sufficiently free of surface imperfections and occlusions to meet optical, mechanical, and environmental requirements of this specification.
   2. Have been subjected to minimum tensile proof test by fiber manufacturer equivalent to 100 kpsi.
D. Factory optical fiber splices are not allowed.
E. Coatings shall be mechanically strippable without damaging optical fiber.
F. Indoor Fiber Optic Cable: Cable shall:
   1. Be suitable for installation in free air, in building risers, in conduit, in cable tray and in innerduct.
   2. Be dielectric materials (no conductive materials).
   3. Be listed as being suitable for use in vertical run in shaft or from floor to floor and shall be listed as having fire-resistant characteristics.
   4. Be listed as suitable for use in air handling spaces (plenum rated).
   5. Meet the following specifications:

a. Jacket Material:	PVC (OFNR) or as required by ceiling type
b. Buffer Diameter:	250 -900 microns
c. (Multi-Mode):	Slate/Grey/Aqua
d. Cable Rating:	OFNP
e. Strength Member:	Aramid Yarn, fiberglass
f. Storage Temperature:	-40° to +70°C (no irreversible change in attenuation)
g. Operating Temperature:	-20° to +70°C (no irreversible change in attenuation)
h. Humidity Range:	0 to 100%
i. Maximum Tensile Strength:	During Installation - 2700 N (no irreversible change in attenuation). Long Term - 1000 N
j. Bending Radius:	During Installation - 20 times cable diameter
k. No Load:	10 times cable diameter

G. Indoor/Outdoor Cable
   1. Not required
H. Armored Cable
   1. Armored cable may be used. Otherwise, provide 1.25" plastic innerduct to route fiber.

2.02 FIBER OPTIC CONNECTORS

A. Connectors shall:
   1. Be LC-type for single mode.
   2. Be LC-type for multimode.
   3. Accept fibers having clad diameter of 125 microns.
   4. Accept fibers having buffered diameter of 900 microns.
   5. Sustain minimum of 200 mating cycles.
   6. Meet the following performance criteria:

TEST PROCEDURE	MAX. ATTENUATION CHANGE
Cable Retention (FOTP-6)	0.2 dB
Durability (FOTP-21)	0.2 dB
Impact (FOTP-2)	0.2 dB
Thermal Shock (FOTP-3)	0.2 dB
Humidity (FOTP-5)	0.2 dB

B. Connector ferrule shall be ceramic.
C. Optical fiber within connector ferrule shall be secured with adhesive.
D. Optical fiber within connector ferrule shall be mechanically secured and index matching gel shall be included in connector.
E. Attenuation per connector shall not exceed 0.3 dB.

2.03 FIBER OPTIC PATCH PANELS

A. Patch Panels shall be:
   1. 12 to 24 strand capacity
      a. Accepts 6 or 12 cartridge panels
   2. Be enclosed assemblies.
   3. Incorporate hinged or retractable front cover.
   4. Be rack mountable on standard TIA/EIA 19" equipment racks.
   5. Provide for strain relief of incoming cables.
   6. Provide for labeling of individual connectors
   7. Incorporate radius control mechanisms to limit bending of fiber to manufacturer's recommended minimums of 1.2", whichever is larger.
   8. Provide protection to both "facilities" and "user" sides of couplings.
   9. Be configured to require only front access when patching.
   10. Include provisions for permanent labeling of fiber optic cables. Labeling shall be accessible from front of patch panel and shall not require disassembly of patch panel enclosure or removal of front cover.
B. LC-type couplings shall be mounted on assembly that snaps into patch panel enclosure. This assembly shall be designed to accept variety of coupler types including, ST, SC, duplex SC and high-density mini-connectors.
C. Access to inside of panel enclosure during installation shall be from front and rear. Panels that require any disassembly of cabinet to gain entry will not be accepted.
D. Incoming cables shall not be accessible from patching area of panel. Enclosure shall provide physical barrier to access of such cables.

2.04 SPLICE CENTER

A. Cable shall be installed continuous without breaks, interruption or splices. Splicing not allowed unless otherwise noted.

2.05 MISCELLANEOUS MATERIALS

A. Fiber Patch Panel Organizer
B. Fiber Jumper Storage Shelf

PART 3 – EXECUTION

3.01 FIBER OPTIC CABLE

A. Provide backbone fiber optic cable as shown on drawings.
B. Route backbone fiber optic cable in innerduct. Ensure innerduct is of sufficient length to avoid innerduct retreating into the conduit during installation of fiber optic cables. Innerduct should extend a minimum of 2' beyond conduit at pull box point of entry at completion.
C. Fiber terminations to TRs may be made using other means including quick connects or mechanical means.
D. Fiber strands shall terminate on Fiber Optic Connectors mated to couplings mounted in Fiber Optic Patch Panels.
E. Provide cable slack in each backbone fiber optic cable.
    1. Slack shall be in addition to length of fiber required for termination requirements.
        a. Store cable slack in enclosure designed for this purpose.
    2. Slack required shall be as follows:
        a. Backbone Intra-Building:
            1) Minimum of 5 meters (each cable if applicable) coiled and secured at one end in MDF.
    3. Backbone Inter-Building:
        a. Minimum of 15 meters (each cable if applicable) coiled and secured at one end in MDF.
F. Fibers with coatings <900 microns shall be furcated (fanned-out) to minimum of 900 microns before termination.
    1. Provide buffer tube fan-out kits for fibers terminated in patch panel couplings.
    2. Provide 2.9 mm subunit fan-out kits for fibers not terminated in patch panel couplings.
G. Visually inspect cables for cuts, blisters and abrasions during installation.

3.02 CABLE ROUTING

A. Run cabling in cable tray pathways provided, or as designated on floor plans, and support from building structure.
B. Cable shall be free of tension at both ends. In cases where cable must bear stress, provide Kellum grips to spread stress over longer length of cable.
C. Route within innerduct or use armored cable without innerduct.

3.03 FIBER OPTIC CONNECTORS

A. Follow manufacturer's guidelines for splices, pigtails and connector type provided.
B. Clean connectors with lint-free pad saturated with 90% to 100% isopropyl alcohol after fiber termination. Wipe with dry, lint-free pad and blow end face with compressed air for minimum of 5 seconds.
C. Insert connectors into patch panel mounted couplings. Provide dust caps for couplings.

3.04 FIBER OPTIC PATCH PANELS

A. Provide Fiber Optic Patch Panels and coupling assemblies at TR's.
B. Provide blank covers for unused coupling assembly spaces in panels.
C. Provide patch panels and horizontal cable management in 19" equipment racks and mount according to manufacturers' recommendations.
D. Provide LC type couplings in coupling assemblies and mount coupling assemblies and blank covers in patch panels.
E. Clean couplings with foam swab and isopropyl alcohol prior to connector insertion. Blow dry with compressed air.
F. Provide minimum of four (4) screws to secure each patch panel onto rack.
G. For routing to attic and basement TRs, provide large conductor cables in riser shafts. Bring fibers to one location within TR and split out to each cabinet. Once fibers are split out they must be physically protected within break out kits, innerduct, smurf tube or split flexible duct.

3.05 TESTING

A. General:
    1. Fibers utilized in installed cable shall be traceable to manufacturer.

2. Contractor shall detail proposed test plan for each cable type, including equipment to be used, test frequencies and wavelengths, etc.
3. Test results shall include record of wavelength, fiber type, fiber and cabling number, measurement direction, test equipment and model number, date reference setup and operator.
4. End-to-end performance tests are required for all cables, all strands.
5. Test results shall be matched to individual fiber labels provided on patch panels. Every test performed and recorded shall be traceable to individual fibers or duplex connectors. Test results labeled generically will not be accepted.
6. Provide power meter test results for ALL fibers and OTDR test results only for longer fibers (see below). Repair or replace any defective fibers.

B. Pre-Installation Testing
1. Submit cable manufacturer's test report for each reel of cable provided.
2. Test reports shall include manufacturers on-reel attenuation test results at 850 nm and 1300 nm for each multi-mode optical fiber and 1310 nm and 1550 nm for each single mode optical fiber prior to shipment from manufacturer.
3. Perform continuity test of fiber cable reels delivered to site.
4. Verify fiber attenuation and length values as specified on cable data sheets supplied with cable reels.
5. Perform tests in one direction at 1300 nm (multi-mode fibers) and 1550 nm (single mode fibers).
6. On-the-reel Bandwidth performance as tested at factory shall be provided upon request.
7. Visually inspect reels and packaging for damage.
8. Contractors not performing this test do so at their own risk. Contractor is liable to replace all defective fiber.

C. Post-Installation Testing:
1. Upon completion of cable installation and termination, the Fiber Optic cabling shall be tested to include:
2. Optical Attenuation (“Insertion Loss” Method). Every installed cable shall be tested using this method, no exceptions.
3. Optical Attenuation shall be measured on all terminated optical fibers in both directions of transmission using the “Insertion Loss” method. Measurement shall be inclusive of the optical connectors and couplings installed at the system endpoints. Minimum 2 meter access jumpers fabricated from the same fiber under test shall be used at both the transmit and receive ends to insure that an accurate measurement of connector losses is made.
4. Multi-mode fibers shall be tested in accordance with the EIA/TIA 526-14A, Method B at 850 plus or minus 30 nm. Single mode fibers (if applicable) shall be tested in accordance with the EIA/TIA 526-7-1998. Method A.1. Testing shall be at 1300 plus or minus 20 nm.
5. Attenuation of optical fibers shall not exceed the values calculated as follows:
6. Attenuation (max.) = (2 x C) + (L x F) +S dB where C is the maximum allowable Connector Loss (in dB), L is the length of the run (in kilometers) and F is the maximum allowable fiber loss (in dB/km). S is the total splice loss (# of splices * max. attenuation per splice).
7. Provide test results in an orderly format (spreadsheet) that matches each test result with identifiable fiber label on patch panel.
8. Power meter test is required of all fibers no matter the length.

D. Verification of Link Integrity (OTDR)
1. Optical Time Domain Reflectometer (OTDR):
2. OTDR tests are required only for backbone cables of 500 feet or longer. If cable is less than 500 feet this section does not apply but may be used in case of a fiber break or for trouble-shooting.
   a. Properly calibrate tester per manufacturer's recommendations.
   b. For short lengths of fiber (under 2,000 feet) set a short pulse width to avoid overpowering device and causing excessive reflections and backscatter.
   c. Measure connector insertion losses at 850 nm and 1300 nm for multimode fibers and 1310 nm and 1550 nm for single mode fibers.
   d. If "gainers" appear, re-test fiber in BOTH directions. Average test results in both directions to cancel out positive and negative readings.
   e. Engineer reserves the right to require OTDR testing in BOTH directions.
   f. OTDR traces shall be performed using access jumpers at the transmit and receive ends.

g. Traces shall be examined for continuity and anomalies to confirm fiber link performance.
h. Launch cord shall be minimum 100 ft. long, or as noted by test equipment manufacturer.
i. Traces shall be examined for continuity and anomalies to confirm fiber link performance.
j. Provide test results in an orderly format (spreadsheet) that matches each test result with identifiable fiber label on patch panel. GENERIC TEST LABELS NOT MATCHING ACTUAL LABELS IN THE FIELD WILL NOT BE ACCEPTED. OTDR TEST LABELS SHALL MATCH ONE-FOR-ONE POWER METER TEST RESULT LABELS WHICH SHALL ALSO MATCH LABELS ON PATCH PANELS. JOB WILL BE REJECTED IF LABELS ARE NOT CONSISTENT AND EASILY CROSS-REFERENCED TO LABELS IN THE FIELD ON PATCH PANELS, CONNECTOR PANELS AND CABLE SHEATHS.
k. Scale shall be set and cursors placed to show principally that portion of the trace that is under test. Adjust scale so that useless scatter beyond section of interest is not shown or outside of cursor field. Also adjust scale so that both launch cords are visible.
l. All OTDR tests shall be consistently presented:
   1) Format
   2) Scale
   3) Units
   4) Cursor placement
   5) Field of view
m. Pre-test acceptance.
n. Prior to completion of final power meter and OTDR tests, provide to engineer for review three sample test results of both of power meter tests and OTDR tests. Consistent formatting is important.
o. After engineer has provided comments and adjustments to contractor (if required), final tests may be completed. If this step is not taken, contractor risks rejection of entire fiber optic installation and test results.

3.06 LABEL IDENTIFICATION

A. In addition to requirements in this Article, comply with applicable requirements in Division 26 Section "Electrical Identification".
B. General Label Requirements:
   1. Mechanically print and install all labels per drawing details.
   2. Format: Select font size to be readable and to fit all information required without overlap of text. Font: Helvetica, Bold.
   3. Use all capital letters. Use a one-line format.
   4. Clean all surfaces prior to attachment of any label. Follow manufacturer's recommendations for cleaning and affixing labels.
C. Fiber Optic Cables:
   1. Confirm labeling scheme with owner.
   2. Locate label in a visible and readable location.
   3. Label Information: The cable identifier is the cable number followed by the cable pair/strand count (numeric characters), both the beginning and ending count.
   4. Provide polyethylene non-conductive cable tags with cable numbers. Provide "Mini-Tags" similar to model number SH as manufactured by Almetek Industries, Inc. The mini-tag holder shall be of sufficient length that the complete number is held in one holder with all information on one line.
D. Cables, General: Label each cable within 4-12 inches of each termination, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
   1. Any discrepancy or dispute of building, room and/or location labeling shall be brought to the owner's attention for immediate resolution.
E. Inside Plant Fiber Optic Cables:
   1. Label Location: On the jacket or sheath of the cable at both ends (before the fan-out or breakout point) and at every splice. Place the label near the cable entrance into the termination hardware and exterior to the termination hardware. Label shall be located in a visible and readable location.
   2. Label Information: Building Number, TR number, fiber count, type and installation date.
   3. Method: Brady label, part number WML-1223-292, or approved equal.
   4. Example: MDF ### to Telcom Room ###, 1-12 mm, 10/20/2012, where ### is the room number.

F. Fiber Termination Enclosure Frames:
   1. Label Location: On the outside of the enclosure surface in the top left corner of the panel front.
   2. Label Information: Near end cabinet number and panel number and fiber type as well as the FAR END cabinet number and panel number.
   3. Example method: Machine printed Brady labels, part number PSL-1833-619-BK, or approved equal.
   4. Example: Cabinet 1, panel 2, SM – to Data Center Cabinet 1 panel 2.

G. Building Fiber Terminations within the Fiber Termination Enclosure Frames:
   1. Label Location: On the inside front panel of the enclosure in the location identified by the manufacturer for the label. In most cases, the manufacturer's label will be used and re-labeled. The connector layout within each closure may vary. In general, the columns of fiber connectors are grouped in units of six to twelve connectors. Columns count from left to right. Termination positions within a column count from top to bottom. Refer fiber termination numbering conflicts to the Owner for a decision.
   2. Label Information: Total fiber terminations within enclosure, 1- 48 maximum. The label for each panel and connector should indicate the FAR END termination location. Anyone can see what is the near end location. What is required is the FAR END location.
      a. Labeled as follows: A1, A2, A3, etc. according to where the FAR END is terminated.
   3. Method: Machine printed Brady labels, part number CL-111-619, or equivalent.

H. TR/MTR:
   1. Label Location: On wall, 12 inches below cabling tray.
   2. Label Information: Building Number, TR number, fiber count, type and installation date.
   3. Method: Adhesive label, 3 inches high with safety orange background and black lettering.
   4. Example manufacturer: 3M P/N: Scotch lite 5025 reflective lettering system or approved equal.

I. Cable Administration Drawings:
   1. Show building floor plans with cable administration point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, terminal hardware and positions.
   2. Follow convention of TIA/EIA-606. Furnish electronic record of all drawings, in software and format selected by Owner. Each fiber strand terminated in patch panel or workstation outlet and each cable entering termination points shall be labeled with unique identifying code.

END OF SECTION

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SECTION 27 15 10
HORIZONTAL COPPER CABLE AND EQUIPMENT

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Base Bid:
   1. Contractor provide:
      a. Horizontal unshielded twisted pair (UTP) station cable consisting of Category 6 cable to function as a universal structured cabling system for both voice and data.
      b. Cable terminations in patch panels and station jacks
      c. Testing, labeling and manufacturer's certification (performance warranty)
      d. Accurate as-built jack plans in AutoCAD format indicating actual field labels at each location.

B. Unit Bid:
   1. Contractor provide alternate unit bid price to:
      a. Add or delete one SIO which includes cable of any length, jack, faceplate, patch panel port, labeling and testing.

1.02 SECTION INCLUDES

A. Unshielded Twisted Pair Cable
B. Miscellaneous Cable
C. Modular Jacks and Faceplates
D. Voice Patch Field
E. Data Patch Field
F. Coax and Connectors
G. Splicing
H. Cable Support
I. Testing Requirements
J. Labeling Requirements

1.03 RELATED WORK

A. Section 27 05 00 - Common Work Results for Communications Systems
B. All references including Division 26 apply

1.04 SUBMITTALS

A. Submit shop drawings for equipment under this section per section 01 30 00 – Administrative Requirements.
   1. Unshielded Twisted Pair Cable
   2. Miscellaneous Cable
   3. Modular Jacks and Faceplates
   4. Voice Patch Field
   5. Data Patch Field
   6. Coax and Connectors
   7. Splicing
   8. Cable Support
   9. Testing Equipment
   10. Labels
B. Submittals should be grouped to include complete documentation of related systems, products and accessories in a single submittal. If provided electronically in PDF format, one specification section should equal one file or file name. Do not scan multiple specification sections into one file.
C. Where applicable, dimensions shall be marked in units to match those specified.

D. Submittals shall be original catalog sheets or photocopies thereof. Facsimile (fax) sheets or printed web pages shall not be accepted. Circle appropriate part number with black pen. Circle appropriate picture if more than one appears on page. Do not use highlighter which cannot be reproduced on a copy machine.
E. Contractor shall indicate on submittal the system(s) served by each cable submitted.
F. Submit manufacturer's installation instructions.
G. For testing equipment, submit current year's calibration certificate.
H. Project Record Documents: Record on plans actual locations of components and information outlets with their associated faceplate labels.
I. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.
J. Warranty: Submit manufacturer's warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
K. Work shall not proceed without Engineer's approval of submitted items.

1.05 PERFORMANCE TESTING

A. The following equipment shall be performance tested
1. Unshielded Twisted Pair Cable
a. Per ANSI/TIA-568-C.2
2. Miscellaneous Cable
a. Per manufacturer recommendations or continuity test at a minimum
3. Modular Jacks and Faceplates
a. Per ANSI/TIA-568-C.2
4. Voice Patch Field
a. Continuity
5. Data Patch Field
a. Per ANSI/TIA-568-C.2
6. Coax and Connectors
a. Continuity and sweep test
7. Splicing
a. Continuity
8. Cable Support
a. Visual inspection, j-hook supports every 48"
9. Testing
a. Equipment to be calibrated yearly (provide certificate)
b. Cables to be tested as described in Part 3 - Execution
10. Labeling
a. Visual inspection to confirm that all faceplates are labeled per Part 3 – Execution or per owner/engineer approved method.

1.06 WORK BY OWNER

A. Owner to provide
1. Final cross connects to voice backbone cable or outside lines
2. Final connections all electronic equipment unless noted otherwise
3. Provision of all patch cords

PART 2 – PRODUCTS

2.01 UNSHIELDED TWISTED PAIR CABLING

A. General:
1. Cabling shall:
a. Be constructed of individually twisted pairs.
b. Be suitable for installation in environment defined.
c. Be packaged to minimize tangling and kinking of cable during installation.

2. Pair twists of any pair shall not be the same as any other pair.
3. Pair twist lengths shall be selected by manufacturer to ensure compliance with near-end crosstalk (NEXT) requirements of ANSI/TIA 568-C.2.
4. Four pair, 23 AWG, with a bisector tape that delivers the performance needed for the unshielded twisted pair, solid copper cables - CATEGORY 6
5. Number of pairs per sheath: 4, 23AWG
6. UL Listing: Non-plenum (CMR) is permitted for new wing of building. Contractor is responsible to provide CMP in old historic building and in any space where there is uncertainty. Contractor to confirm ceiling/cable type prior to ordering cable. Refer to section 27 05 00, 1.01.G for more information.
7. Color Coding:
   a. White-Blue
   b. White-Orange
   c. White-Green
   d. White-Brown
8. Conductor Resistance: 7.61W per 100/Meter at 68° (maximum)
9. Characteristic Impedance: 100W +/- 15% @ 1 to 100 Meters
10. Maximum Attenuation: 2.0 dB/Meter @ 1.0 MHz or 5.0% above TIA 568 15.6 dB/Meter @ 62.5 MHz
11. Capacitance: 5.6 nF/100m at 1kHz
12. Near End Crosstalk: 71 dB @ 1.0 MHz or 6dB above TIA 568 49.4 dB @ 62.5 MHz

B. Station Data Cable:
1. Manufacturers: Systimax/Uniprise, Belden, Panduit, Hubbell
2. Cable shall:
   a. Be a single vendor/brand end to end solution with better than minimally compliant performance ratings.
   b. Do not mix and match cable/connector manufacturers – all shall be of ONE brand. Only exception is Pan/Gen.
   c. Be non- plenum rated. CMR or CMP as described above
   d. Shall be used for both voice and data applications.
   e. Blue color sheath
   f. Category 6, capable of 1 Gig transmission and utilizing 802.3AT Power over Ethernet (PoE+) at 25 Watts
   g. Exceed ANSI/TIA 568-C.2 performance specifications for Category 6 by average of 2dB.
   h. Better than minimally compliant Category 6.

2.02 MISCELLANEOUS CABLING

A. Speaker/sound system, security and audio-visual cable – see applicable specifications (if required).
B. Patch Cords – by owner

2.03 MODULAR JACKS AND FACEPLATES

A. General:
1. Manufacturers: To match brand of station data cable
2. Voice/data jacks shall snap into mounting frame, which shall mount into faceplate.
3. Jacks and connectors may be mounted directly into faceplate.

B. Faceplates:
1. Faceplates shall:
   a. Be constructed of high impact plastic (except where noted otherwise).
   b. Color shall be white. **Confirm final color of faceplate with engineer or architect prior to ordering and installation.**
   c. Be configured to mount on standard, single gang outlet box when wall mounted.
      1) Exception: Conference/meeting room projector outlets to be double gang faceplates
   d. Incorporate recessed designation strips at top and bottom of frame for identifying labels.
   e. Triple row faceplates with no provisions for labeling of middle outlet row are not acceptable.

f. Designation strips shall be fitted with clear plastic covers.
g. Accommodate minimum of 4 modular jacks and connectors.

2. Faceplates for wall mounted voice-only outlets (wall-phones) shall accommodate wall-mounted telephone sets.
   a. Faceplate shall be stainless steel construction, accommodate 1 voice jack, mount on standard single gang outlet box and include mating lugs for wall phone mounting.
3. All device plates in Mechanical Rooms shall be brushed stainless steel with proper openings for the wiring device.

C. Voice & Data Jack:
1. Data Jacks shall:
   a. Meet the following specifications:
      1) Category: 6
      2) Shall be "tuned" to match data cable in every respect as a "certified" system.
      3) **Be of same brand as selected cable** unless prior engineer approval is obtained.
   b. Be non-keyed, 8-pin Modular Jack (8P8C).
   c. Be pinned per 568B with pair as follows:
      1) Pair 1 - Pins 5 & 4
      2) Pair 2 - Pins 1 & 2
      3) Pair 3 - Pins 3 & 6
      4) Pair 4 - Pins 7 & 8
   d. Data – Blue in color
2. Interface between jack and station cable shall be insulation displacement type contact. Termination components shall be designed to maintain cable's pair twists as closely as possible to point of mechanical termination.
3. Jack contacts shall have minimum of 50 micro-inches of gold plating.

2.04 VOICE PATCH FIELDS

A. General:
1. Cross connect blocks shall:
   a. Be designed to maintain cable pair twists as closely as possible to point of mechanical termination.
   b. Identify pair position by color designation.
      1) Colors shall be Blue, Orange, Green and Brown for Station Cables and Blue, Orange, Green, Brown and Slate for Backbone Voice Cables.
2. Each horizontal row of cross connect blocks shall be capable of terminating one 25 pair binder group of Backbone Voice Cable, or six 4 pair Station Voice Cables.

B. Backbone Voice Cable and Station Voice Cable Blocks:
1. Manufacturers: To match brand of station data cable
2. Blocks shall be wall mounted 110-style cross-connect blocks.
3. Termination equipment shall meet full Category 5e performance criteria (even though cable is Cat 6 – blocks are only for voice circuits).
4. Mechanical termination on cross connect bocks shall:
   a. Have ability to terminate 22-26 AWG plastic insulated, solid and stranded copper conductors.
   b. Provide direct connection between station or backbone cable and jumper wires.
   c. Have less than 0.2dbB attenuation.
   d. Have less than 100 m ohms of DC resistance.
   e. Have less than 5 m ohms of resistance imbalance.
   f. Have minimal signal impairments at all frequencies up to 250 MHz.
5. Blocks must utilize a transition technology from 110 style (to backbone cable) to RJ-45 style to horizontal cable. Intent is for owner to be able to use only RJ-45 patch cords for both voice and data patching. 110 blocks may be tied to an auxiliary block for RJ-45 transition using either integrated circuit board connections on the same block, or using a remote block with Amphenol connectors.

2.05 DATA PATCH FIELDS

A. Data Patch Panels:

1. Manufacturers: To match brand of station data cable
2. Panels shall:
   a. Be rack mountable in standard TIA 84”H x 19"W equipment racks.
   b. Match cable and jack type, compatible with Cat 6 “certified system”.
   c. Consist of modular 110-type connector system or blank panels able to accept snap-in jacks.
   d. Have ability to seat and cut 8 conductors (4 pairs) at a time.
   e. Have ability of terminating 22-26 AWG plastic insulated, solid and stranded copper conductors.
   f. Be designed to maintain cable's pair twists as closely as possible to point of mechanical termination.
   g. Have cable support and strain relief devices to secure cables at 110-type termination blocks.
   h. Insure minimum bend radius requirements are satisfied.
   i. Have color-coded designation strips to identify cable types and ID numbers.
   j. Be flat or angled to permit direct access to vertical cable managers.
   k. Permit individual cable or jack labeling.
   l. Provide sufficient patch panel ports for current project plus 25% spare, unused ports for future use by owner.

2.06 COAX AND CONNECTORS

A. Station Coaxial Cable shall be RG-6 type
   1. Manufacturers: CommScope, Belden or match brand of station data cable
   2. Construction (RG-6 type, quad-shield):
      a. Center Conductor: 18 AWG copper-clad steel (0.040" nominal outer diameter).
      b. Dielectric: Gas expanded (foamed) polyethylene (0.180" nominal diameter).
      c. First shield: Aluminum-polypropylene-aluminum laminated tape with overlap bonded to dielectric.
      d. Second shield: 34 AWG aluminum braid wire (60% coverage).
      e. Third shield: Non-bonded foil shield.
      f. Fourth shield: 34 AWG aluminum braid wire (60% coverage).
      g. Jacket: Flame retardant PVC (0.300" nominal outer diameter). Jacket shall contain carbon black to ensure ultraviolet light stability (UV). Provide plenum rated cable where required by code.
   3. Specifications:
      a. Impedance: 75 ± 3 ohms
      b. Velocity of Propagation: 87% nominal
      c. Maximum Attenuation @ 68°F: 1.60 dB/100 ft. (55 MHz)
      d. 5.65 dB/100 ft. (750 MHz)
      e. Cable Rating: Type CATVR or plenum rated as required by installation location
      f. Flame retardant PVC (plenum rated) outer jacket.
   4. Coax Connectors
      a. Coaxial Connectors shall be threaded male F-type.
      b. Male F-connectors shall:
      c. Be matched to the RG-6 cable type used
      d. Be a single piece connector
      e. Incorporate a 1/2" crimp ring using hex crimp
      f. Use female/female feed-through couplings for coaxial outlets and patch panels.
B. PASSIVE DEVICES (SPLITTERS AND TAPS)
   1. General
      a. Manufacturers: Blonder Tongue, Regal, Phoenix Communications Technologies (PCT.), Channel Commercial Corp., PicoMacom, Channel Vision, PDI.
      b. Impedance: 75 Ohms.
      c. Bandwidth: 5 MHz - 1000 MHz.

d. FRY ports type F female.
e. Where more than one connector exits from common surface of device, connectors shall be spaced minimum of 0.925" apart, center-to-center.
f. Indoor-rated devices may not be equipped with grounding wire attachment points.
g. Outdoor-rated units shall be equipped with grounding wire attachment points.
h. Each port or device shall be labeled. Designations shall be in accordance with following:
i. Common port shall be labeled as "common", "in", or "input".
j. Directional couplers/taps port receiving greatest percentage of input signal shall be labeled "thru", "through", "out" or "output".
k. If nominal loss is in excess of 1 dB, port shall also indicate nominal loss from input to output.
l. Port(s) receiving lower percentage of input signal shall be labeled "tap:
m. Shall be labeled with nominal loss from input in form "-N dB" where "n" is nominal loss.
n. Splitter output ports shall be labeled "out" or "output" and shall include port number.
o. Ports shall also indicate nominal loss from input to port in form "-n dB" where "n" is nominal loss.
p. Labels shall indicate port function and signal loss.
q. Components which do not meet environmental requirements (salt spray, corrosion resistant and rated from -40°F to +140°F) shall be permanently labeled "For indoor use only".

2. Splitters:
   a. Splitters shall:
   b. Be available in 2, 3, 4, 6 and 8 port options.
   c. Specifications:

	2-way	3-way	4-way	6-way	8-way
Insertion Loss	≤ 4.4 dB	≤ 7.8 dB	≤ 8.2 dB	≤ 12.5 dB	≤ 12.5 bB
Out-to-Tap Isolation	≥ 18 dB	≥ 20 dB	≥ 18 dB	≥ 20 dB	≥ 20 dB
Return Loss	≤ 20 dB	≤ 20 dB	≤ 20 dB	≤ 20 dB	≤ 20 dB

3. Taps (Directional Couplers):
   a. Taps shall:
   b. Be available in 1-way, 2-way and 4-way options.
   c. Specifications:
      1) 1-Way Taps

Tap Value (Isolation) (± 1.3 dB):	5 dB	8 dB	11 dB	14 dB	17 dB	20 dB
Insertion Loss	≤ 3.4 dB	≤ 1.8 dB	≤ 1.7 dB	≤ 1.5 dB	≤ 1.3 dB	≤ 1.2 dB
Out-to-Tap Isolation	≥ 18 dB	≥ 21 dB	≥ 18 dB	≥ 22 dB	≥ 22 dB	≥ 22 dB
Return Loss	≤ 20 dB	≤ 20 dB	≤ 20 dB	≤ 20 dB	≤ 20 dB	≤ 20 dB

      2) 2-Way Taps

Tap Value (Isolation) (± 1.3 dB):	8 dB	11 dB	14 dB	17 dB	20 dB
Insertion Loss	≤ 4.1 dB	≤ 2.9 dB	≤ 2.0 dB	≤ 1.5 dB	≤ 1.2 dB
Out-to-Tap Isolation	≥ 24 dB	≥ 24 dB	≥ 22 dB	≥ 24 dB	≥ 26 dB
Tap-to-Tap Isolation	≥ 18 dB	≥ 18 dB	≥ 18 dB	≥ 18 dB	≥ 18 dB
Return Loss	≤ 20 dB	≤ 20 dB	≤ 20 dB	≤ 20 dB	≤ 20 dB

      3) 4-Way Taps

Tap Value (Isolation) (± 1.3 dB):	11 dB	14 dB	17 dB	20 dB
Insertion Loss	≤ 4.1 dB	≤ 2.5 dB	≤ 1.9 dB	≤ 1.3 dB
Out-to-Tap Isolation	≥ 22 dB	≥ 24 dB	≥ 26 dB	≥ 26 dB
Tap-to-Tap Isolation	≥ 18 dB	≥ 18 dB	≥ 18 dB	≥ 18 dB
Return Loss	≤ 20 dB	≤ 20 dB	≤ 20 dB	≤ 20 dB

2.07 SPLICING

A. Splices are not allowed unless indicated on project documents.

2.08 CABLE SUPPORT

A. J-Hooks
   1. Wide-base design with smooth, beveled edges providing a large bending radius for all J-Hook sizes.
   2. Meets ISO/IEC 18010, TIA-569-B and is used for large-diameter cable, including Cat. 6A
   3. Accommodates a variety of attachment methods – threaded rod, wall mount, etc. and is expandable for additional integrated pathways
   4. Easily attaches to other fasteners in multiple configurations: J-Hook- to- J-Hook or J-Hook to fasteners
   5. Requires no screws, rivets or special tools for installation of fastener assemblies, tree bracket assemblies or puller assemblies.

B. "Arlington" Loop or Saddle Cable Hangers
   1. Provides sturdy reliable support of Category 5, 6 or fiber optic cable without sagging, bending or damaging the cable
   2. UL/CSA Listed for Environmental Handling Spaces
   3. Flexible and non-metallic
   4. Single or multiple LOOP hangars mount in a variety of ways and rotate to any angle
   5. Sizes/Cable Holding Capacity - 2" holds a 2" cable bundle, 2.5" holds a 2.5" cable bundle, and 5" holds a 5" cable bundle
   6. Available with or without UV rating

C. Bridle Rings
   1. Bridle rings (made of round stock) by themselves are not acceptable
   2. Bridle rings may be acceptable if used in conjunction with wide-surface plastic saddle inserts

2.09 TESTING EQUIPMENT

A. Hand-Held Portable Tester
   1. Level III field tester for Category 6 class E cabling for up to 250 MHz
   2. Level IV field tester for Category 6A class EA cabling up to 500 MHz
   3. Factory calibrated yearly (certificate for current year must be provided)
   4. Capable of printing individual cable test results in text and graphical formats
   5. Capable of printing one sheet per test or roll up of many tests on one sheet indicating simple PASS or FAIL result
   6. Capable of converting files to PDF format
   7. Tester interface adapters must be of high quality and be capable of using the installed connectivity manufacturer's patch cables for performing permanent link certification testing.
   8. Capable of Auto-Testing from either the display unit or the remote unit to decrease testing time

2.10 LABELING

A. See section 27 05 53

PART 3 – EXECUTION

3.01 CABLE INSTALLATION REQUIREMENTS

A. Station Data Cable
   1. Provide Station Data Cable from SIOs to TRs.
   2. Terminate Station Data Cables in rack mounted Data Patch Panels.
   3. Station Data Cables shall be home run to TRs from SIO locations.
   4. Cables shall have pair twists preserved to point of termination
   5. Cable jacket shall be continuous to within 1/2" of termination or as recommended by certified system.
   6. Terminate cables using 568B wiring standard.
   7. Terminate Cable pairs in TRs and at SIOs.

8. Maximum station cable length shall not exceed 295 ft. (90 meters) measured from termination block in TRs to SIO, including slack required for installation and termination. Contractor is responsible for installing station cable to avoid unnecessarily long runs.
9. Any area that cannot be reached within above constraints shall be identified and reported to Engineer immediately. Installation shall not proceed for cables beyond prescribed distance limitations. Notify engineer of any cables that will be between 270 and 295 feet long.
10. Provide data cable to every CCTV camera location noted on prints
    a. Contractor to coordinate camera locations with CCTV vendor. CCTV vendor is responsible to indicate to data cabling contractor precise location for each camera data outlet. Typically, camera data jacks are to be located above ceiling tile near camera locations.

B. Cable Routing
1. Cabling shall be run in raceways provided, or as designated on floor plans.
2. Cable shall be free of tension at both ends. In cases where cable must bear stress, provide Kellem grips to spread stress over longer length of cable.
3. Make every effort to run cables in TRs and riser shafts neatly, straight, well dressed, labeled on every floor and organized according to type or function.
4. Where station cables must pass between floors (because no TR exists on same floor), gently contain cable bundle within loop of Velcro straps and label cable bundle with TR destination including floor number and TR room number.
5. To reduce effects of EMI, the following minimum distances shall be adhered to:
    a. 5" from power lines of 2kVA
    b. 18" from high voltage lighting (including fluorescent)
    c. 39" from power lines of 5kVA or greater
    d. 39" from transformers and motors

3.02 MISCELLANEOUS CABLE

A. Provide and install cable as recommended by manufacturer
B. Furnish patch cords to owner

3.03 MODULAR JACKS AND FACEPLATES

A. Provide one faceplate per communications outlet symbol (faceplate) shown on Project Documents.
B. Provide data jack(s) in faceplates as shown on Project Documents.
C. Terminate all pairs of Data Station Cable in their respective jacks.
D. Mount jacks into faceplates and secure faceplates to outlet box or modular furniture.

3.04 VOICE PATCH FIELDS

A. General:
1. At TRs, terminate Backbone Voice Cables and Station Voice Cables on backbone and station cross-connect blocks.
2. Provide horizontal troughs incorporating distribution rings to accommodate jumper routing.
3. Position troughs at top and/or bottom of each cross-connect block and between each column of blocks.
4. Cabling entering and exiting fields shall be neatly laced, dressed and supported.
5. Provide tie cables and auxiliary punch blocks near horizontal cable patch panels for easy patching between horizontal cable and riser cable.
6. Intent is to permit owner to use only RJ-45 patch cables for both voice and data patching from rack to wall field.
7. Auxiliary voice patch blocks need only connect center two pins for tip and ring function to backbone cable.

3.05 DATA PATCH FIELDS

A. Data Patch Panels:
1. Provide patch panels as shown on the Project Documents.
2. Mount patch panels in 19" equipment racks or wall mount brackets.
3. Provide minimum of four (4) screws to secure each patch panel onto rack.

3.06 COAX AND CONNECTORS

A. Provide backbone cable as indicated on project documents.
B. Provide horizontal cable as indicated on project documents.
C. Provide appropriate connectors on each cable end.
D. Terminate only TV end of cable. Leave TR end of cable on wall with 10 foot slack coil for final termination by local cable TV vendor (or owner).

3.07 CABLE SUPPORT

A. Provide J-Hooks or other approved cable supporting device for cable where cable tray and conduit are not available.
   1. Support cable support devices by means of threaded rod and/or beam clamps suspended from building structure or from building structures themselves such as trusses, joists, rafters, beams, columns and walls.
   2. If walls are used, devices must be attached only where wall studs serve as support. Supporting screws must penetrate into studs.
   3. Cable supporting devices must be supported on four (4) foot centers, plus or minus one (1) foot.
   4. Do not utilize supports for other systems (such as drop ceiling wire) without prior approval of engineer or construction manager.

3.08 CABLE TESTING

A. Hand Held Tester
   1. Calibrate field tester each day as required by manufacturer.
   2. Adjust NVP (nominal velocity of propagation) values, temperature, cable brand, etc. specific to the cable brand being installed.
   3. Test each cable per ANSI/TIA-568-C.2 standards.
   4. Save each test result and label results to match actual field labels.
   5. Print test results or provide in electronic (PDF) format.
B. Station Data Cable
   1. Test each installed link to 250 MHz as required by ANSI/TIA-568-C.2 for compliance with specified performance characteristics utilizing a Level III tester or as required by manufacturer to obtain system warranty and as required by ANSI/TIA-568-C.2 Category 6 requirements.
   2. Each pair of each horizontal cable shall be verified for wire map (transposed/reversed/split pairs) and shorts through toning of each conductor.
   3. Maximum length of station cable shall not exceed 90 meters.
   4. Worst case performance, based on maximum length of 90 meters, shall meet ANSI/TIA-568-C.2 standards.
   5. Tests made and documentation provided shall consist of wire map, Power-Sum near-end crosstalk, Power-Sum equal level far-end cross talk, return loss, attenuation, cable length and resistance using TDR technology.
   6. Test results shall meet or exceed cable manufacturer's requirements for Cat 6 certified system Any cable that does not meet manufacturer's requirements for a certified system shall be retested or replaced at contractor expense until cable meets the requirements.
   7. Submit Test Results for each Horizontal Link in electronic form a) in the native format of the test instrument and b) summarized in a fashion that includes a graphical display of all test parameters in PDF form.
   8. The summary shall document the worst-case margin over minimal TIA "Category" compliance for the cables tested. The summary shall be in Adobe Acrobat PDF format.
C. Coaxial Cable:
   1. Test each cable for end-to-end continuity using tone generator or other testing device.
   2. Use Time Domain Reflectometer (TDR) to verify cable length and to test for cable faults and breaks.
   3. Use step-function high resolution Time Domain Reflectometer, such as Tektronix 1502C or Hewlett-Packard 1415A.
   4. Results shall be automatically plotted on X-Y plotter with Y axis voltage reflection coefficient resolution of .001 per division. X axis shall resolve down to 1" of cable.

5. TDR will sweep cable at rate no greater than 50 ft. per second, or such lower rate as necessary to resolve cable faults to the 1" and .001 VRC level.
6. After connection to Cable TV service, test each coax (television) outlet for signal strength.
7. Each coax outlet shall test to +3dB to +10dB.
8. Hook up room TVs or use temporary, portable TV to visually test and inspect channel reception and picture quality at every location. Picture quality shall be acceptable to owner/engineer. Provide notification to owner 24hrs in advance of visual inspection test.

3.09 LABEL IDENTIFICATION

A. Station Cable
1. Refer to section 27 05 53
2. Label each SIO faceplate and each cable entering SIO and TRs with unique identifying code.
3. Label cable with tag, which is wrapped around cable sheath
4. Place faceplate labels on outside of cover
5. Place data and voice punch down block labels above or below the termination
6. Labeling shall be by mechanical means in black ink on non-removable tags
7. Hand lettered designations are not allowed
8. Station Cabling labeling code shall be as follows:
   a. A-B-CCC where:
      1) A = Room number of TR where cable terminates
      2) B = Floor Number (optional if room number already gives floor indication). Begin with floor on which jack is terminated
      3) CCC = Jack number in sequential order on that floor, e.g. 001, 002, 003, etc. Start number sequence over on every floor
      4) Example: Jack number 101 on floor 3 terminates in TR 318: 318 -101 (no need for separate floor designation in this case).
9. Faceplate labels can use common room number designations on each label strip. For example, two data jacks served from TR 318 sharing a common label strip could be represented by:

TR130	
101	102

10. Label all patch panels in TRs with identical label as used on jacks
11. Labels on as-built documentation and test results to match field labels
12. Prior to installing labels, consult with owner to verify labeling scheme

END OF SECTION

SECTION 27 40 00
AUDIO-VISUAL SYSTEMS

PART 1 – GENERAL

1.01 SECTION INCLUDES
A. Equipment Standards
B. Cabling
C. Conduit Requirements

1.02 RELATED WORK
A. Drawings and general provisions of the Contract, including General Conditions and other Division 01 specification sections apply to the work of this section.
B. All references to Division 26 - Electrical work shall apply.
C. Section 26 05 00 - Common Work Results for Electrical
D. Section 26 05 29 - Hangers and Supports for Electrical Systems
E. Section 26 05 33 - Raceway and Boxes for Electrical Systems, including conduit and raceway for AV systems, electrical power for AV systems, and grounding.
F. Section 27 05 00 - Common Work Results for Communications Systems
G. Section 27 15 10 – Horizontal Copper Cable and Equipment

1.03 SUBMITTALS
A. Conform to requirements in Division 1 and Section 27 05 00.
B. Completed shop drawings shall be provided for consultant's approval. In addition, drawings may be provided in electronic form (.DWG format, PDF format). CONTRACTOR SHALL NOT PROCURE EQUIPMENT OR BEGIN WORK ON THIS PROJECT UNTIL SHOP DRAWINGS HAVE BEEN SUBMITTED AND APPROVED.
C. Submittal documents must be provided within 60 days of award of contract, or sooner if necessary to comply with construction schedule. Contractor is solely responsible for all costs resulting from delay in providing shop drawings in a timely manner.
D. These submittals or shop drawings shall include:
   1. A complete equipment list of all components including quantities.
   2. Manufacturer's catalog specification cuts and printed descriptive literature on all components being provided.
   3. A complete list of all cable runs including termination locations and numbers/identification schedule.
   4. Schematic drawings of all system wiring including one-line connection diagram. The diagrams shall show schematic wiring of the equipment and all connections to be made to devices. Terminal connections in the equipment shall be numbered to correspond to the diagrams for use in making connections. Wiring diagrams shall be coordinated so that terminal numbering, circuit designation and equipment or device designations are the same on all drawings. All drawings must be submitted and approved by the Consultant before fabrication starts, but such approval will not waive any specification requirements unless so specifically stated. Final approval will be made after checking the equipment when operated in the field. For submittals, all of the above drawings shall be made on 24" x 36" reproducible media.
   5. Speakers and projectors, including mounting details. Manufacturer cut sheets are acceptable.
   6. Page-by-page screen shots of AV touch panel control for meeting rooms. Narrative or matrix describing programming functions, routing functions and utility controls. This submittal must be provided 90 days prior to installation and programming. This submittal constitutes a “proposal” of intent. The owner will review and provide feedback and coordination for final programming and user interface controls.
   7. One-line diagram of matrix switch, amplifier(s), DSP, inputs, outputs, spare ports, etc.

1.04 PERFORMANCE TESTING

A. Testing of all installed cable and equipment shall be performed by the contractor as soon as practical after equipment is installed.
B. All cable and equipment shall be tested with state-of-the-art, industry standard test equipment by personnel properly trained to operate equipment.
C. Testing shall be accomplished before notifying Engineer of substantial completion and before punch list is performed.
D. A performance checklist shall be created by contractor to document operation and testing of all equipment. Checklist shall be delivered to Engineer prior to punch list and project acceptance.

1.05 WORK INCLUDES

A. The scope of work covered under this Section includes but is not limited to:
   1. All labor, materials, equipment, tools and services required to perform all work and services for execution, installation and completion of all Audio-Visual (AV) work including all parts lists, operating instructions, and wiring diagrams shown on the drawings and as specified and completely coordinated with all other trades. Equipment and installation labor as noted on the Contract Documents for a fully functional system. Miscellaneous components, hardware, interconnections and terminations required for proper operation of all systems.
   2. All components or systems indicated on the Contract Documents.
   3. The Installing Contractor shall be responsible for the following:
      a. Verification of accuracy and completeness of equipment lists, dimensions, mounting details and equipment compatibility
      b. Accurate documentation of the system operation and installation.
      c. One year warranty of the equipment and installation.
      d. Test equipment, tools, ladders, lifts and scaffolding required for installation.
      e. Daily and final cleanup of debris caused by installation.
      f. Quality Control / Commissioning of system
      g. End user training and training manuals
B. All supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete communications installation.
   1. Complete and in operative condition and to approval of Architect/Engineer, materials described herein and shown on drawings.
   2. Coordination with other trades as required.
   3. Complete adherence to equipment manufacturer's recommendations to assure complete, optimal operation. Contractor shall notify Engineer where such recommendations appear to contradict project documents.
   4. Equipment, materials and accessories for communications systems as shown and noted on the drawings including but not limited to the following:
      a. A complete raceway system including conduit, outlet box, pull boxes, junction boxes, sleeves and hangers. This work may be separated out for completion by the Division 26 contractor. This contractor shall coordinate with the GC and Division 26 contractor to assure conduit and power is provided where required for all AV systems.
      b. Maintaining of all communications and other low voltage connections outside of or passing through the work area to other areas (if work is a renovation).
      c. All cutting and patching to accomplish wiring tasks.
      d. All conduit penetrations through walls and floors and complete fire stopping of penetrations per standards of a national testing laboratory.
      e. Creation of new cable pathways through areas where no pathway currently exists.
      f. New wiring devices, jacks and cover plates.
      g. Complete testing, certification and creation of as-builts for all equipment locations.
C. Furnish all materials and labor to provide complete and professionally installed systems in working order. Programming and functionality of the AV systems will be the responsibility of the AV Contractor(s). The AV Contractor(s) is expected to work in conjunction with the Owner's Staff to complete the system installation to owner's satisfaction.
D. AV Contractor(s) shall provide any and all connectors, hardware, transformers, power supplies, rack panels, interfaces, fasteners, wire harnessing materials, bushings and any other incidentals required for

complete and proper functioning of this system whether specifically listed or not. Provide proper projector lens as required for application, screen size and throw.

E. In the case of a manufacturer discontinuing the manufacture of a certain piece of equipment required by this project, the contractor shall provide a new submittal for a new product that is the newer version of the discontinued product from the same manufacturer.
F. Manufacturer's warranties to be in full effect for a minimum of one (1) year from substantial completion. The exception being commercial grade monitors must have a (3) year warranty. This statement shall be considered for all sections of this document for this project.
G. Contractor shall include in their bid performance of a one-hour presentation of intended functionality of the system to the engineer and/owner to verify understanding of system and to answer questions.
H. Costs are to include the staging checkout process of a sample AV system. See requirement below in Part 3.
I. Functional Tests
   1. Contractor shall conduct functional tests of all equipment to verify everything is in working order and functioning as intended prior to training or turn-over.

1.06 DESCRIPTION

A. This section covers general requirements associated with the installation of audio-visual systems within the project. Refer to sections listed below for more specific system requirements. Multiple spaces (rooms) with multiple systems may be covered under this section.
B. Furnish all materials and labor to provide complete and professionally installed systems in working order. Programming and functionality of the AV systems will be the responsibility of the AV Contractor(s). The AV Contractor(s) is expected to work in conjunction with the Owner's Staff to complete the system installation to owner's satisfaction.
C. AV Contractor(s) shall provide any and all connectors, hardware, transformers, power supplies, rack panels, interfaces, fasteners, wire harnessing materials, bushings and any other incidentals required for complete and proper functioning of this system whether specifically listed or not. Provide proper projector lens as required for application, screen size and throw.
D. AV contractor shall act as the Owner’s agent in coordinating with the EC regarding conduit, power, enclosures and device locations. This does not relieve the contractor from performing his due diligence in installing equipment per manufacturer's recommendations and delivering a completely functioning system.
E. Additional information concerning the design intent is contained both within this document and on AV system drawings.
F. Where conflicts exist between drawings and specifications, the contractor must bring the discrepancies to the project AE's attention no later than ten (10) days before the bid due date, or, if noticed after the bid award, prior to installation of equipment. Contractor shall deliver a completely functioning system regardless of discrepancies in the documents. This statement shall be considered for all sections of this document for this project.
G. Purchase date(s) shall be within 3 months of the time the equipment is intended to be installed in the building.
H. In the case of a manufacturer discontinuing the manufacture of a certain piece of equipment required by this project, the contractor shall provide a new submittal for a new product that is the newer version of the discontinued product from the same manufacturer.
I. Any changes made to the equipment specifications after bidding that result in increased cost will be considered changes to the contract and will be processed accordingly. The change in cost resulting from owner selecting a more current projector model shall be handled as follows:
   1. The manufacturer's suggested retail price (MSRP) of the bid product shall be obtained.
   2. The MSRP of the new model selected by owner shall be obtained.
   3. The difference between the MSRP of the two models shall be calculated.
   4. If the change in MSRP between bid model and new model is positive, that shall be the amount of the change order due to the contractor.
   5. If the change in MSRP is negative, that shall be the amount due as a credit to the owner.

J. The work that is to be performed by the AV Contractor(s) under this specification shall include the following:
   1. Meeting Room 109:
      a. RTI Touch Panel control
      b. Crestron also acceptable
      c. Wall Plate
      d. Projector
      e. Projection screen
      f. AV rack under counter near door
      g. Overhead speakers
      h. Blu-Ray player
      i. Distribution/matrix switcher, amplifier, coax cable TV and RJ45 network interface and other equipment as required
      j. Shielded HDBaseT cables and connectors
      k. Speaker wire
      l. Refer to project documents – AV one-line for additional requirements
   2. StoryTime Room 110:
      a. RTI Touch Panel control
      b. Crestron also acceptable
      c. Wall Plate
      d. Projector
      e. Projection screen
      f. Overhead speakers
      g. Shielded HDBaseT cables and connectors
      h. Speaker wire

1.07 BIDDER QUALIFICATIONS

A. AV contractor(s) shall perform the entire work of this section. These contractors shall be regularly engaged in the installation and service of audiovisual systems including but not limited to those systems listed.

B. AV Contractors must meet the following qualifications:
   1. Capability to provide all systems within full and strict compliance with all provisions of this specification.
   2. Has been actively engaged in the installation of AV systems included under this section for a minimum of five years.
   3. Be a certified a dealer of the products which they are installing.
   4. AV contractor shall furnish upon request, a list of five projects whose size, value, scope and complexity is similar to that being bid. The minimum period of operation for each shall be 12 months. For each facility listed provide:
      a. Name and location of installation.
      b. Date of occupancy by Owner.
      c. Owner's representative to contact and their telephone number.
      d. Construction Manager or General Contractor and Architect's project manager and their telephone numbers.
   5. AV contractor shall have access to all necessary equipment and has organizational capacity and technical competence necessary to enable performance of this work properly and expeditiously.
   6. Contractor shall employ adequate number of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this section.
   7. Contractor shall provide a designated supervisor present and in charge on the project site during all phases of installation and testing of the system.
   8. Contractor shall be prepared to furnish copies of the installation documents from a previous similar installation.
   9. Contractor shall be prepared to furnish a list of test and calibration equipment for the servicing and alignment of AV systems.

10. Contractor shall have AutoCAD ability to create one-line shop drawings and accurate as-built record documents.
11. Contractor's compliment of equipment shall include, but is not limited to:
    a. Sencore CP5000 display analyzer system or equivalent.
    b. Sencore Test pattern generator.
    c. Fluke Network Cable Analyzer.
12. Has a record of satisfactorily completing past projects. Criteria that will be considered in determining satisfactory completion of project by Contractor will include:
    a. Completed contracts in accordance with drawings and specifications.
    b. Diligently pursued execution of the work and completed contracts according to the established time schedule unless the Owner grants extensions.
    c. Fulfilled guarantee requirements of the Contract Documents.
13. The AV contractor supplying the equipment shall show satisfactory evidence, upon request, that it maintains a fully equipped local service organization capable of furnishing adequate inspection and service to the systems, including replacement parts. The service organization shall be capable of a minimum 4 hour on site response time. The contractor shall produce evidence that it has had a fully experienced and established service organization for at least five (5) years and proven satisfactory installations during that time.
14. The Consultant reserves the right to request and have furnished to him any additional information he requires to determine the AV contractor's ability to complete the work. Such additional information shall be supplied with no additional costs incurred by the Owner.
15. The A/E will make such investigation as is deemed necessary to determine the ability of the AV contractor to perform the work.
16. Certification:
    a. The Installing Contractor shall have a current AVIXA CTS certification

C. Installing Contractor Personnel Qualifications:
1. Summary: The Installing Contractor shall assign at least one full-time employee to the work whose qualifications meet the following minimum requirements.
2. On-Site AV Supervision
    a. Certifications:
        1) Shall have a current AVIXA Certified Technology Specialist certification with an installation endorsement (CTS-I) in good standing
        2) Installation contractor shall have on staff a certified CTS-D person for design review. Certifications shall be provided upon request.
            a) Minimum 5 years experience with good references may substitute for this certification requirement.
    b. Qualifications:
        1) Shall be capable of supervising a turn-key audiovisual system installation including, but not limited to, all cabling, loudspeakers, projection equipment, mounting hardware and electrical components including the necessary equipment, interconnections, transducers, labor, and services required to meet the functional requirement outlined in the Contract Documents.
        2) Shall provide all quality control (QC) and safety inspections as needed throughout installation.
        3) Shall conduct all AV system commissioning tests, and proof-of-performance testing/demonstration in accordance with the Contract Documents.
    c. Other Installation Personnel:
        1) Certification: CTS certification from AVIXA (Infocomm)
    d. Qualifications:
        1) Shall be capable of working within industry standards with minimal supervision. The work shall include, but is not limited to, cabling, loudspeakers, projection equipment, mounting hardware and electrical components including the necessary equipment, interconnections, and transducers and the downloading, or installation, of pre-developed control programs in the field.
    e. On-Site Support Personnel:
        1) Certification:

a) CTS Preferred Qualifications:
b) Has a good general knowledge of AV installation procedures and standards, and must be trained in construction site safety. Performs support work under direct supervision of CTS-D and CTS-I installers.
c) AV Control Programmer: AV control and DSP programming for system equipment includes recommendations for control system features and functionality; input to AV system design; control system logic diagram, control system performance specification, block diagrams, control system program and user interface, system debug, program and source code and other system documentation as required.
d) Certification
e) Must have a CTS certification, CTS-I or CTS-D certification preferred
f) Individuals performing the AV control programming shall have manufacturer's control system programming training and certification for the specified AV control system
g) Individuals performing AV-DSP programming and setup shall have manufacturer's system programming training and certification from the manufacturer for specified equipment.

f. Sub-contracting of AV work
1) Conditions:
a) Sub-Contractors must conform to the same certification standards listed above, and have prior approval.

D. Installing Contractor Regulatory Requirements:
1. All equipment and installations under this contract shall conform to the following:
a. ANSI/NFPA 70 National Electrical Code.
b. ANSI/IEEE C2 National Electrical Safety Code TIA/EIA Standards 568 A (including TSB 67), and 607.
c. IEEE/ANSI 142 1982 Recommended Practice for Grounding of Industrial and Commercial Power Systems.
d. ANSI/TIA-569B Commercial Building Standard for Telecommunications Pathways and Spaces
e. NFPA 72-2010; National Fire Alarm and Signaling Code [intelligibility requirements]

1.08 SERVICE

A. On-the-premises service, parts and labor is to be provided by AV contractor during normal working hours at no cost to the Owner, for a period of 12 months from the date of final acceptance. AV contractor must respond within 24 hours or the next business day to requests for service. AV contractor must also provide technical support via telephone at no charge during the warranty period.
B. On-the-premises service must also be made available at other than normal working hours, and shall be charged by the AV contractor's service representative at current labor rates minus normal hour rate.
C. The AV contractor shall maintain engineering and service departments capable of rendering advice regarding installation and final adjustment of the systems.

1.09 MAINTENANCE AND OPERATING MANUALS

A. Upon project completion the Contractor shall provide four complete sets, in hard cover binders, of maintenance and operating instructions for this system and any software, CD-ROMs, DVDs or other materials provided by the manufacturer. These manuals shall include the following:
B. A table of contents.
C. Simplified operational procedures with diagrams depicting the actual equipment front panels showing the nominal level settings for the controls.
D. Question and answer type trouble-shooting guides.
E. One copy of approved system As Built drawings.
F. The AV contractor shall maintain in their office a record of all original manual information to be able to issue as a replacement copy, at the Owner's expense, during the time the equipment is in actual service.
G. See General Requirements Division 01.

1.10 AS-BUILT CONSTRUCTION DRAWINGS

A. Drawings included with the specifications set shall be modified by the AV contractor to denote as-built information, and shall be included as part of the as-built documentation. As built documentation shall include a complete list of all cable runs including termination locations, numbers/identification, and test data as required under the section on commissioning.

B. The drawings are to include cable routes and outlet locations. Outlet locations shall be identified by their sequential number as defined elsewhere in this document. Numbering, icons and drawing conventions used shall be consistent throughout all documentation provided.

C. The owner, through the Consultant, will provide floor plans in paper and electronic (".dwg", AutoCAD rel. 14) formats on which as-built construction information can be added. These documents will be modified accordingly by the contractor to denote as-built information as defined above and returned to the Consultant for acceptance. This information shall be supplied to the Consultant/Engineer no later than two (2) weeks after the completion of the project.

D. The Contractor shall annotate the base drawings and return to the A/E in hard copy (same plot size as originals). Hard copies are REQUIRED. Electronic copies are OPTIONAL.

E. Each drawing submitted by the Contractor as part of the Project Documentation shall be identified as an "As-built" drawing and include the following:
   1. The Contractor name and/or logo
   2. The date of the drawing

F. If electronic files are utilized, all fonts, color, layer, Model Space/Paper Space conventions established in the base drawings shall be retained by the Contractor in preparation of the As-built drawings.

G. If electronic files are utilized, prior to generation of the drawings, the Contractor shall provide a sample file and test plot to the Engineer for review and approval.

H. All documentation, including hard copy and electronic forms shall become the property of the Owner.

I. If drawings are submitted by AV contractor in electronic form as "As-Builts" or "Record Drawings", they shall adhere to all CAD standards as outlined in the most recent edition of A/E's CAD standards manual.

1.11 WORK PRODUCT OWNERSHIP

A. Throughout the course of the project, all supporting documentation, work-in-progress, programed source code and software, written and electronic files, including all documentation and software necessary to edit and adapt the system, shall remain the property of the Owners and shall be provided to the Owners upon project completion and/or at any time during the course of a project upon request in an unsecured, unencrypted and easily modifiable format as prescribed by the Owners.
   1. All deliverables to be supplied to the Owners on compact disc media, and/or printed materials when requested

B. Software – Control System, DSP, and All Other Applicable Equipment
   1. The Owner shall be granted a license in perpetuity for use. The following requirements shall apply.
      a. All source code becomes the exclusive property of the Owner.
      b. All source code changes must be fully documented.
      c. All custom programs for remote control system touch panels, and other programmed devices, shall become the property of the Owner and shall be submitted with the final systems documentation, and/or as requested in the DVD/CD-ROM and USB solid state media.
      d. Subsequent to system certification, source code changes and/or additional programming, whether requested by the Owner or performed by the Installing Contractor, will be warranted by the Installing Contractor for a period of one (1) year, with the Installing Contractor responsible for the diagnosis and repair.
      e. The vendor shall ensure that the current program is saved to CD-ROM and/or USB-solid state media, and backed up on electronic hard-disc/server.
      f. No program resident in a control system shall be overwritten until a back-up of the resident program is made.
      g. All documentation, not residing in the code, must be provided on CD-ROM and/or USB-solid state media in Adobe PDF and Microsoft Office format.
   2. The Installing Contractor shall also offer an annual “Software Maintenance” contract.

a. This shall cover all software provided as part of this system and/or written for this system, and shall include both routine upgrades to applications and operating systems, as well as any modifications to software that may be required by any company.
b. The Software Maintenance contract shall commence immediately after expiration of the warranty period, and continue for three (3) years.

3. Written Release:
   a. A written release will be given by the Installing Contractor for all control programming done by the Installing Contractor's personnel or sub-contractors. The release shall acknowledge the Owners ownership and right to modify programming directly, or to have the programming modified by others on the Owners' behalf.
   b. A CD shall be supplied with the written release that includes the program and source code for the system in an unencrypted format.

PART 2 – PRODUCTS

2.01 EQUIPMENT STANDARDS

A. Complete AV systems consisting of all the individual systems as shown and specified are required. Equivalent manufacturers and products shall be in strict accordance with this specification. Substitutions during the construction phase may be permitted only with prior approval from the Owner's Staff and in writing from the AV consultant.

B. Contractor shall provide all products required for a complete working system that complies with the design intent of the project documents. Where contractor perceives a better way to solve a problem, or products that are more readily available, or products for which the contractor has a greater familiarity, confidence and certification, he is not precluded from proposing such products and schematics that meet the design intent.

C. It is the responsibility of the AV contractor to verify the completeness of the drawings, specifications and schedules and the suitability of devices to meet the intent of the specifications. Any additional equipment, accessories or incidentals required, whether or not specifically mentioned herein, shall be provided by the contractor without claim for additional payment, it being understood that a complete operational system is required.

D. All materials and equipment shall be new and unused. Unless specifically approved by the Consultant, all materials and equipment in the system shall be the standard design or model ordinarily supplied as a product item by manufacturers regularly engaged in the production of such equipment. They shall be the manufacturer's latest standard designs current at the time of delivery, modified only to the extent necessary to comply with the requirements of these specifications. Where two or more units of the same class of equipment are required, such units shall be the standard product of a single manufacturer, but individual classes of compatible equipment may be the products of different manufacturers. Manufacturers shall be established in the industry so that prompt and continued service and delivery of spare parts may be assured.

E. All equipment quantities listed in audiovisual specification sections are for reference only and could vary depending on the type of manufacturer equipment provided. Refer to schematic drawings to provide consultant approved quantities to meet design intent.

F. All components that comprise the various systems shall be UL listed where a UL listing exists for that component or system.

G. Equipment provided by this contractor shall be fully coordinated with all other equipment required for complete system function. This includes power, cooling, cabling, mounting equipment and locations, and controls.

H. **Contractor shall anticipate future cost increases of equipment in their bid, whether such increases are due to inflation or technology change**. Technology changes frequently and manufacturers change or discontinue products. Contractor shall make reasonable assumption regarding possible cost increases and technology changes in the period between bidding and installation.

I. **Contractor shall provide current models at time of installation**. Do not provide older models no longer in production or out of service.

2.02 SUBSTITUTIONS

A. Consideration for substitutions during the construction phase shall be allowed in light of a significant gain or advantage in quality of product or considerable cost savings to the Owner. It is the contractor's responsibility to obtain approval on all substitutions prior to installation. FAILURE TO OBTAIN APPROVAL FOR SUBSTITUTIONS SHALL BIND THE CONTRACTOR TO PROVIDING THE SPECIFIED EQUIPMENT WITHOUT REQUEST FOR ADDITIONAL PAYMENT. Contractors request for approval shall include the reason for requesting the substitution along with any relevant product data.

B. Requests for substitutions must be made at least 20 days prior to intended installation.

2.03 EQUIPMENT SPECIFICATIONS

A. Acceptable brands include:
   1. Hitachi, Panasonic, QSC, BMS, Extron, Crestron, AMX, RTI, Da-Lite, Biamp, Shure, Audio-Technica, Middle Atlantic, Sony, FSR, Kramer, Chief, Mid-Atlantic, JBL, Steelcase, Samsung and others as approved by Engineer and owner to meet the intent of the design.
   2. Products may be mixed and matched to provide the best value and technical solution for the Owner.
   3. Certain products must integrate seamlessly, therefore families of products once chosen must be used throughout to assure this integration.
   4. Monitors shall be of commercial quality having no less than a 3-year warranty and able to perform 24x7x365,

2.04 AV CONTROL SYSTEM

A. Wall mounted control device: Crestron
   1. Contractor to customize programming and labeling per project documents or owner requirements.

B. Control System
   1. Option 1
      a. RTI – KX4
   2. Option 2
   3. Media Presentation Controller 302
      a. MPC3-302-W
      b. Controller
         1) Model may be altered to accommodate required inputs and outputs
         2) Control of screens may be from control processor or power sequencer depending on functionality of model selected.

2.05 PROJECTION

A. Manufacturers: Optoma Hitachi, Epson, NEC, Sony, Panasonic
   1. Sample model: Optoma ZU506T-W

B. Minimum Specifications
   1. Similar to Optoma ZU506T-W
   2. Aspect ratio: 16:10 (WUXGA)
   3. Resolution: 1920x1200
   4. Lumens: 5000 ANSI min.
   5. Mounting: ceiling pole or suspended cables, coordinate with architecture
   6. Contrast: 300,000:1
   7. Audible noise: 36 dB max
   8. Compatibility: HDTV: 720p, 1080i, 1080p
   9. Light source: laser phosphor
   10. Digital Keystone and lens shift: horizontal and vertical
   11. Focus: power
   12. Zoom: power, 1.40:1
   13. Optimal Throw: 12 feet, ratio: 1.4 – 2.24:1
   14. Life: 20-30,000 hours
   15. Voltage: 110V – 240V

16. Speaker output not required
17. FCC class A
18. Inputs: HDMI, USB, RS-232, Ethernet/IP RJ45
19. EDID and HDCP compatibility
20. Lens as required for resolution, brightness and throw
21. Engineer approved equivalents will be considered

C. Projector Mount
1. Manufacturers: Optoma, Hitachi, Chief, Peerless, Premier, Polaris
2. Use pole mount from ceiling structure at approximate throw of 13 feet from screen

2.06 AUDIO

A. Digital Signal Processor:
1. Biamp Nexia CS
2. QSC 110f
3. Others as approved

B. Speakers:
1. Manufacturers: QSC, JBL, Extron, Quam, Bogen, Armstrong and Atlas Sound

C. Amplifiers:
1. Manufacturers: QSC, Extron, Crestron, Biamp, Peavey, Bogen, Atlas or approved others
2. Minimum specifications for Labs and other small rooms
   a. Watts: as required to fulfill requirement on project documents, plus 50%, then round up to nearest standard size.
   b. Separate channels as indicated on project documents.
   c. Different rooms shall be on separate zones
   d. Combine smaller amps as required to obtain channel separation or zones.
   e. Ports as required to connect to audio sources and outputs.

D. Wireless Microphones:
1. Manufacturers: Shure QLXD 14/93
2. Lapel or lavalier style for presenter with belt pack
3. Receiver (located in AV cabinets)
4. Remote antenna for Community Rooms A+B
   a. RF carrier frequency range: 470-952 MHz
   b. Range: 100m typical
   c. Audio frequency range: 25-15,000 Hz
   d. Audio output level: XLR connector into 600 ohm load, ¼” connector into 3k ohm load.
   e. 14-18Vdc, negative ground, 600mA ac external adapter
   f. Refer to Shure QLXD 14/93
   g. Could also be infrared carrier
   h. Must prevent overlap to nearby rooms while used simultaneously
5. Body pack transmitter with lavalier mic (for presenters)
   a. Provide two (2) lapel mics with transmitters for Community Rooms
   b. Gain adjustment range: 40dB
   c. Impedance: 1 M ohm
   d. RF power output: 30 mW
   e. Power: 9V alkaline battery
   f. Battery life: 8 hours
   g. Lapel clip, lavaliere mic

E. Assisted Listening System (ALS):
1. Williams Sound PPA 458 PRO
2. One base station for each space or room as indicated on project documents
   a. (1) PPA T45 Transmitter
   b. (4) PPA R38 Receivers
   c. (2) NKL 001 Neckloops
   d. (4) EAR 022 Surround Earphones
   e. (1) ANT 025 Whip Antenna
   f. (1) TFP 048 Power Supply

g. (1) WLC 004 Main Power Cord (U.S.)
h. (1) WCA 013 RCA Audio Cable, 3ft.
i. (4) BAT 001-2 AA Alkaline Batteries
j. (1) IDP 008 Wall Plaque
k. (1) ANT 005 Coaxial Antenna
l. (1) RPK 005 Rack Panel Kit

3. Provide over-the-ear headphones, not ear buds
4. Sufficient UHF channels to prevent classroom overlap
5. ADA compliant range up to 300 ft. line of sight
6. RF output power minimum: 100mW
7. Base station power supply: DC 12-18V
8. Dynamic range of receiver: >96dB
9. Receiving mode: single channel diversity
10. Frequency range: per manufacturer
11. Headphone audio output: stereo, 20mW, line stereo level -10dB
12. AF Headphone Response: 100Hz to 10Khz; Line: 40Hz to 15kHz (+/-3dB)
13. Selectivity: 50dB
14. Modulation mode: FM
15. Receiving sensitivity: at 5dBuV over 80dB S/N ratio
16. Remote antenna ability so receivers may be located in AV control room while antenna can be remotely located in auditorium or Majors lab.
17. Remote antenna cable as required
18. Provide ADA required/approved signage at ALS station

2.07 PROJECTION SCREENS

A. Specifications:
1. Projection screens
a. Manufacturer: Draper
b. Others as approved
c. Tensioned-Access Series V
d. Flush in ceiling when not in use
e. Firmly suspended from building structure
f. HD 0.9 gain
g. Color: White
h. Motorized
i. Aspect Ratio: 16:10
j. Diagonal: 106” plus or minus 2”
k. Viewable: 90”x56” plus or minus 2”
l. Minimal (nominal) black border all sides: 2”, varies at sides for tensions, varies at top as required for projector alignment
m. Low voltage AV control
n. Toggle override switch, wall mount
o. Alternate brands: Draper, Elite Screens
p. Contractor to verify dimensions prior to ordering
q. Contractor to verify black border at top of screen and carefully coordinate that border with location of projector mount and ability of projector to shift image if required.

2.08 TRANSMITTERS / RECEIVERS /PRESENTATION SWITCH

A. Specifications:
B. Provide System of contractor choice
1. AV over IP using Ethernet switch, or
2. HDBaseT using Cat6 shielded cable, or
3. HDMI with extenders as needed
4. As required by manufacturer to convert HDMI and VGA signals to balanced signal over Category 6 UTP.
5. Minimum ports: HDMI, converted to RJ45, transmitter and receiver pairs as required.

C. Capable of the following
   1. Inputs
      a. Minimum (4) four (video) HDMI inputs, plus others as noted below
      b. Local PC (or network)
      c. Local wall plate for visitor presentations
      d. Cable TV or off-air channels (cable box)
      e. Blu-Ray player/streaming
      f. Other inputs to include lapel wireless mic (receiver)
      g. Control signals from wall controllers
      h. Network RJ45
   2. Outputs
      a. Minimum (4) four (video) outputs, plus others as noted
      b. Projector #1
      c. Projector #2
      d. Projector #3
      e. Alternate video device or monitor elsewhere in bldg.
      f. Audio extraction/decoupler
      g. Audio out for amplifier/speakers
      h. Audio out for assisted listening system
D. Provide separate power injectors as required for PoE function of AV touch panel and other equipment as required.
E. Provide all patch cords as required to AV equipment and to OFOI structured cabling system ports.
F. Crestron PoE Injector, 802.3AF Compliant as needed.
G. Contractor may substitute AV over IP system in lieu of HDBaseT if cost and technology are advantageous for project.
   1. If devices cannot transmit program audio with HDMI, provide additional phoenix connector and cable at each Transmitter/Receiver device.
   2. Crestron NVX-350 Encoder/Decoder as required
   3. Others as required for complete system function utilizing Cat 6 video transport
   4. Similar to RTI VX44-18G
   5. Contractor to propose a product to meet design intent and indicate on one-line submittal
H. Scalers
   1. Some transmitters, receivers or matrix switchers may have built-in scalers
   2. If not, provide additional scalers at projectors and monitors to assure proper scaling of images and resolutions for different input equipment
   3. Proper implementation of EDID (extended display identification data) in input ports of matrix switch may preclude the need for separate scalers. Contractor is responsible to make certain all inputs will display properly on all devices.

2.09 BLU-RAY PLAYER

A. SONY UBP-X800M2
   1. 4K Ultra HD
   2. Streaming
   3. Or similar

2.10 LAPTOP PC AND/OR TOWER PC

A. Owner furnished, owner installed

2.11 PATCH CORDS

A. Contractor to provide all patch cords required for complete function of all systems. This includes all patch cords indicated on project documents as well as others that may not be shown, but are required for system function. These could include, but not limited to: HDMI, RJ45, VGA, 3.5mm program audio, USB.
B. Provide patch cords for all A|V equipment where floor boxes and wall plates are in use.

2.12 EQUIPMENT RACKS

A. Manufacturer
   1. Mid Atlantic, Rittal, Damac

B. Requirements
   1. AV equipment rack or under-counter cabinet to fit under casework
   2. Slide-out or swing-out for easy access under casework
   3. Cable management connectors, loops or fittings in rear for support of patch cables and power distribution units.
   4. 19” standard mounting width
   5. Black painted finish

2.13 CABLING

A. All applicable provisions of the NEC and local codes shall apply. All cabling and wiring shall be in metallic conduit or raceway, or supported securely with approved j-hook devices. All AV systems conduit, raceway and standard enclosures are to be provided by the electrical contractor according to drawings provided and in accordance with applicable provisions of Division 26. Specialized enclosures are to be provided by the AV systems contractor.

B. All BNC type connections shall employ true 75 ohm connectors.

C. All cabling shall be in accordance with manufacturer's recommendations. If the manufacturers recommended cabling for equipment proposed as equivalent in quality and performance cannot be accommodated in the conduit indicated in the contract documents, without exceeding normal fill or code requirements, the contractor shall furnish and install the additional required conduit without cost to the Owner.

D. In the case of Extron DTP and XTP products, use Extron’s XTP DTP 24 shielded Category 6 cable for video, audio and control transport to and from RX and TX devices.

E. All cabling shall be either enclosed within conduit or supported by cable tray. J-hooks are not to be used, or only in pre-approved locations.

F. All systems wiring shall be color coded with labeling and coding as submitted and approved by shop drawing.

G. Cabling shall be continuous and shall not be spliced between equipment. Color coding and tagging shall be maintained throughout the system at all accessible locations to the cabling.

H. This Contractor to provide shielded Cat 6 cabling as required for HDMI point-to-point equipment operation (as well as all other cabling required for equipment operation). In the case of Extron DTP and XTP products, use Extron’s XTP DTP 24 shielded Category 6 cable for video, audio and control transport to and from RX and TX devices. Otherwise use a shielded Cat6 cable.

I. AV system cabling is divided into classes that may not be intermixed within a conduit or raceway. Conduits for different AV cabling classifications must maintain minimum separations from each other and from other services. In certain cases, AV system cabling of different classes may pass through or terminate in a common enclosure provided that proper separation is maintained within the enclosure. AV system cabling may not be intermixed with AC wiring within a conduit, raceway or enclosure. AV system cabling may not be intermixed with wiring related to any other trades or discipline including but not limited to; fire protection, HVAC, CATV, alarm, intercom, master clock, access control or other similar systems within a conduit, raceway or enclosure.

J. Wiring classifications, type and minimum separations are as follows. Not all cabling will apply to all projects. They are noted here as a reference.

K. All voice/data/audio/visual cabling run free air (not in conduits) must meet or exceed NEC requirements and be suitable for the environment for which it is installed (plenum rated).

L. Microphone Level:
   1. 22 Ga. Stranded copper (7x30), insulated conductors, shielded twisted pair, bonded foil shield 100% coverage and 22 A WG stranded tinned copper drain wire. ASTM tinned copper conductor 22 A WG. Polypropylene insulation thickness: 008 (.20mm) Overall bonded @ shielded with aluminum foil. Overall 75° C PVC jacket Nom. jacket thickness .020" (.51 mm) Nominal O.D. 135" (3.43 nun) Electrical Characteristics: Nominal capacitance: 34 pf/ft.> 67 pf/m. Nom. D.C.R. @ 20°C: 17 Oil 000 ft. Nom. Velocity of Prop. : 66%
   2. Maintain minimum 6" separation from conduits containing other low voltage services. Maintain minimum 12" separation from long parallel conduit runs containing AC voltages below 250

volts. Maintain minimum 24" separation from long parallel conduit runs containing AC voltages greater than 250 volts.

3. Acceptable: West Penn 454 or approved equal by Canare

M. Line Level Audio:

1. 22 AWG Stranded copper (7x30), insulated conductors, shielded twisted pair, bonded foil shield 100% coverage and 22 AWG stranded tinned copper drain wire, ASTM tinned copper conductor 22 AWG, Polypropylene insulation thickness: 008 (,20mm) Overall bonded @ shielded with aluminum foil. Overall 75·C PVC jacket Nom, jacket thickness, 020" (.5 I nun) Nominal OD, 135" (3.43 mm).
2. Electrical Characteristics: Nominal capacitance: 34 pf/ft.* 67 pf/m. Nom. D.C.R. @ 20·C: 17 n/1000 ft. Nom. Velocity of Prop. 66%
3. Maintain minimum 6" separation from conduits containing other low voltage services. Maintain minimum 12" separation from conduits containing AC voltages below 250 volts. Maintain minimum 24" separation from conduits containing AC voltages greater than 250 volts.
4. Acceptable: West Penn 454 or approved equal by Canare

N. Speaker Level Audio:

1. Insulated copper, twisted pair or THHN sized per drawings. # t0 THHN or twisted pair for sub-woofers, #12 twisted pair equal to West Penn 227 for all direct coupled loudspeakers, # 16 twisted pair equal to West Penn 225 for other speakers.
2. Maintain minimum 6" separation from conduits containing other low voltage services, Maintain minimum 6" separation from conduits containing AC voltages below 250 volts. Maintain minimum 12" separation from conduits containing AC voltages greater than 250 volts.
3. Acceptable manufactures: Belden, Covid, Extron, West Penn, Whirlwind, Canare

O. AV Control System:

1. 18 Ga. Stranded copper minimum, or greater as required for distance and current draw, Insulated conductors, quantity and shielding as required per equipment manufacturer. Maintain minimum 6" separation from conduits containing other low voltage services, Maintain minimum 12" separation from conduits containing AC voltages below 250 volts. Maintain minimum 24" separation from conduits containing AC voltages greater than 250 volts.
2. Acceptable manufactures: Crestron, AMX, Extron

P. Composite Video:

1. Nominal 75 ohm characteristic impedance. RG6 type, 18 Ga, Solid copper center conductor. Gas injected foamed polyethylene, or fluorinated ethylene propylene dielectric. Bonded foil 100% shield and tinned copper braid. Nominal velocity of propagation not less than 85%. Attenuation shall not exceed 3db @ 200MHz at 100'. Capacitance shall not exceed 17pF/foot. Maintain minimum 6" separation from conduits containing other low voltage services.
2. Maintain minimum 12" separation from conduits containing AC voltages below 250 volts. Maintain minimum 24" separation from conduits containing AC voltages greater than 250 volts.
3. Acceptable: Belden I 694A or approved equal by Canare.

Q. Coaxial Video Connectors:

1. Use only true 75 ohm crimp type connectors. Twist on type connectors are not acceptable. Acceptable: AMP 221185-1 Dual Crimp Gold Pin BNC (75 Ohms); Amphenol31-70000 Dual Crimp Gold Pin BNC (75 Ohms); Kings 2065-10-9 Dual Crimp Gold Pin (75 Ohms); Trompeter UPL220-20 Dual Crimp Gold Pin BNC (75 Ohm); ADC BNC1694D; Dual Crimp Gold Pin BNC (75 Ohm)

R. Cat 6 (or better) Cable

1. Shall meet ANSI/TIA/EIA-568-A Category 6 standards
2. Where multiple services are included in transport, including video, use shielded cable with shielded jacks for HDBaseT transport.

S. HDMI Cable

1. HDMI, 2.1 Supports data rates up to 48 GBPS, 1080p and 4K120 @ 60hz without cable equalizer.
2. Non-Plenum

2.14 CONDUIT REQUIREMENTS

A. Conduit requirements for AV systems cabling may differ from those of Project's other trades. It is important that the electrical contractor become familiar with these specialized requirements.
B. AV systems cabling must be enclosed within metallic conduit or raceway as shown in bid documents, or supported by approved j-hook devices. Conduit, raceway and floor boxes shall be furnished and installed by electrical contractor. Conduits containing different wiring classes must maintain minimum separations. Conduits sizes and quantities shown on bid documents are minimums.
C. AV contractor to provide additional ENT or “smurf tube” as required for cable routing where EMT conduit is not available.
D. Separate conduit runs specified in bid documents may not be combined for any purpose.
E. Conduit runs entering or exiting equipment racks must be electrically isolated from the equipment rack by use of non-metallic bushings, a short run of non-metallic raceway, or other suitable means.
F. Conduits shall run uninterrupted from the end device to the nearest accessible cable tray or to the nearest AV cabinet within casework.

PART 3 – EXECUTION

3.01 GENERAL

A. Verify dimensions and conditions at the project site. Submit any conflicts in a timely manner for resolution. AV contractor shall coordinate their efforts with other trades to ensure timely completion of their work and to avoid conflicts over scheduling, access and locations of their work.
B. Materials to be furnished shall include all back boxes and all wire and cable.
C. Furnish all mounting brackets. raceways, sleeves, rack rails, termination plugs, jacks, faceplate mounting hardware, and other unique components as necessary to securely mount equipment and panels.
D. Furnish all required equipment whether or not specifically mentioned in these specifications or all the drawings. Such devices shall include but not be limited to hardware, fasteners, rack screws, rack brackets, power supplies, fan guards, impedance matching devices, transformers, line pads, line amplifiers, relay and LED power supplies, and other devices as necessary to interface, control, or balance the AV systems. Facilitate the integration of other room systems including lighting control systems and existing overhead page system.
E. Furnish painting and finishing as required to match components, cabinetry, and room decor.
F. Contractor shall determine the "installed" price for the AV system in each sub system. The costs are to include material, labor, installation, testing, documentation, commissioning, manuals, training, warranty; and the AV proportion of the Schedule of Values consisting of general conditions, bond, mobilization, record drawings, punch list, cleanup, and demobilization.
G. Install projector mount to building structure according to manufacturer's recommendations. Contractor must verify that projector mount location complies strictly to the throw distance from the screen as recommended by the projector manufacturer for the specific projector to be installed. Make every attempt to install projector mount at the center point of the throw range.
H. Install projector to mount according to manufacturer's recommendations.
I. Verify correct projector throw to screen location prior to mounting any equipment. Every projector model has a different throw requirement. It is the responsibility of the contractor to verify the manufacturer's suggested throw distance from the screen to the projector lens prior to mounting any equipment. The contractor shall rely only on the manufacturer's throw specifications, not on any drawing dimension or directions from any other party.
J. Refer to Architectural sheets for approximate projector and screen placement. Coordinate actual field placement with other utilities. Notify AE team of any conflicts.
K. Provide angle iron, Unistrut, steel pipe and other structural components as required to support projector from building structure. Coordinate unique requirements with architect or general contractor to provide what is required that is not within the capabilities of the AV contractor.
L. Adjust speaker placement as required to suit field conditions.
M. Provide additional cable to connect existing paging system to page override port on Control Module in each room. Provide necessary cable, connectors, transformers or baluns to integrate the existing overhead page system with the new audio system in each classroom.

N. Provide projection screens as indicated on project documents. Consult with Architect as required if questions arise concerning screen placement or mounting.
O. Install projection screens in accordance with manufacturer's instructions using manufacturer's recommended hardware. Install plumb and level. Do not field cut screens.
P. Adjust projection screens and related hardware in accordance with manufacturer's instructions for proper placement and operation.
Q. Coordinate projector placement with screen size and height for proper projector throw and tilt.
R. Protect all installed products until completion of project. Touch up, repair or replace damaged products before substantial completion.
S. Avoid conflicts with light fixtures, switch locations, sprinkler heads, architectural features, casework and other items. Contractor shall visit site prior to ordering high value equipment that could be impacted by sight conditions.
T. No screen or projector shall be installed that has known, observable obstructions between screen and projector that will prevent a full, complete image from being displayed or from being visible by all audience members. Contractor shall relocate or replace screens or projectors that do not permit full function and viewability.

3.02 CONTROL

A. AV System Control:
   1. Provide system programming to permit user control of all input and output routing on graphical user interface (touch panel) or push button interface on wall.
   2. Control to include all audio and video source inputs being routed to all audio and video device outputs.
   3. Graphic user interface (GUI) layout shall comply with AVIXA standards as well as Owner preferences. If push button device is used, provide printed labels or programming for each button.
   4. Contractor shall provide screen shots of proposed GUI layouts or button configuration for owner approval once basic programming or layouts have been accomplished but before final programming. Owner requires time to review proposed layouts and routing in order to provide comments to the contractor.
   5. Provide submittal indicating button-by-button and page-by-page programming and GUI layouts for owner and engineer approval.
   6. The contractor shall provide programming in accordance with owner comments and shall provide allowance in bid to accommodate this coordination with owner. Contractor shall seek out owner prior to final programming and provide personnel to coordinate with owner for programming and GUI layout. No change order will be accepted to comply with Owner requests for programming changes to meet their needs unless such changes are requested after final acceptance and project completion.
   7. Refer to project documents for inputs and outputs. Programming and GUI shall account for and accommodate all inputs and outputs.
   8. Programming and GUI shall propose certain short cuts or standard configurations that will make instructor use easy and streamlined.
   9. The top of the GUI should have a menu of options for easy selection of pages or functions
   10. GUI pages or functions may be organized according to function or equipment, for example:
      a. Video or content inputs
         1) Laptop
         2) Blu-Ray
         3) Tower PC
      b. Projection screen outputs
         1) Screen 1
         2) Screen 2
         3) Screen 3
      c. Audio inputs
         1) Audio shall follow video
         2) Instructor mics (voice lift)
      d. Audio outputs

1) Overhead speaker control for voice lift
2) Stereo speaker control for program audio
3) Assisted Listening System

e. Utilities
1) Screen 1, 2, 3 up and down
2) Projector 1, 2, ,3 on and off

11. The basic function of the rooms is as follows:
a. Option 1:
1) Meeting room (with two screens – projectors #1 and #2) to function independently, each screen displays the same image, audio follows the image. Projectors #1 and #2 always display the same image.
2) Storytime room (with one screen – projector #3) to function independently, the screen displays a separate image from the meeting room – when movable partition is closed. Audio follows the image.
3) Controller in Storytime should never be able to override Controller in Meeting room.

b. Option 2
1) When movable partition is open the rooms are to function together, as one large room.
2) All three screens display the same image and audio is the same for both rooms.
3) The Control panel in Meeting Room becomes the master and controls all content.
4) The Control panel in Storytime becomes inoperable or locked so that it cannot override the master control.
5) A contact switch may be provided at the closure of the movable partition to signal the controllers of Option 2.

12. The GUI touch panel should present the instructor with certain simple choices, defaults, standard configurations or pre-sets such as Presentation Mode 1, Presentation Mode 2, etc. or as directed by owner.
a. For instance, Presentation Mode 1 or Pre-Set 1 might cause primary laptop content to be displayed on screen 1, while secondary tower PC content to be displayed on screen 2.
b. Presentation Mode 2 might be primary laptop content to be displayed on screen 1 while screen 2 is retracted for viewing of content behind the projection screen.
c. Presentation Mode 3 might be document camera input to be displayed on all screens, etc.
d. For instance, Presentation Mode 1, 2 or 3 may also automatically direct certain projectors to turn on or off, and certain screens to be up or down (coordinated with projectors).
e. Contractor shall consult with owner regarding preferences for such functionality.
f. During building renovation, but before AV installation, owner and engineer reserves the right to provide more detailed direction for system programming and GUI layouts. But in the absence of further direction, contractor remains responsible to provide screen shots, submittals and owner coordination.
g. In addition the simple or pre-set modes, utilities shall have a page to permit individual, minute functions of each item. For instance, screens shall have a page permitting individual control of each screen.

13. The presenter should also have the option to individually select which inputs are routed to which outputs.
a. For instance, the presenter may wish to cause laptop image to be displayed on screen 2, and screen 1 be retracted.
b. This mode should allow instructor complete control of all inputs and outputs.
c. Contractor shall consult with owner regarding preferences for such functionality.

3.03 PREPARATION

A. Contractor shall perform a one-hour presentation of intended functionality of the system to the engineer and/owner to verify understanding of system and to answer questions.

B. Before starting installation, verify proper installation of the following work by others
1. Inspect site.
2. Document and submit a single report for each space with AV to the Owner before any work is started on-site.

3. Carry out this requirement for each phase of work on-site (field wiring, and system/equipment installation) for each space with AV
4. Frequency Coordination - Prior to ordering equipment, the Installing Contractor shall coordinate the frequencies of all wireless devices to prevent unwanted interaction between devices and rooms.
5. This includes, but is not limited to, wireless microphones, assisted listening system devices, wireless control panels, etc.
6. Frequency coordination shall take place with the use of a spectrum analyzer and frequency allocation/analysis software.
7. Documentation of this frequency coordination shall be provided to the Owner for review.

3.04 QUALITY CONTROL/COMMISSIONING

A. Required testing and testing procedures are included in the Contract Documents
   1. The main AV milestones that testing will be required:
   2. Prototype verifications (off-site and on-site)
   3. Final System Checkout
      a. Provide programming checklist (button by button) for system check out and verification.
   4. Final Checkout

3.05 WIRING

A. All cables and wiring are to be logically, legibly and permanently labeled for easy identification. Each wire shall be permanently marked with a number at each end. This applies to wire within a rack assembly as well as wire running in conduit. Labels on cables to be adhesive strip type covered with clear heat-shrink tubing. Factory stamped heat shrink tubing may be used in lieu of the adhesive strip style label. Hand-written or self-laminating type labels are not acceptable.
B. Wiring designations shall be an alpha-numeric code that is unique for each cable. Locate the cable designation at the start and end of each cable run and within 2 inches of the point of termination or connection. Label must be printed in three lines so that the designator is visible from all angles. For cable runs that have intermediate splice points, the cable shall have the same designation throughout with and additional suffix to indicate each segment of the run. Actual cable designation assignments shall be determined by the installing contractor. The overall system of wire designators shall be uniform throughout the entire project from sub-system to sub-system.
C. Provide adhesive labels on the rear of equipment where cables attach to indicate the designation of the cable connected at that point.
D. Exposed cables shall be enclosed with surface raceway.
E. All screw on terminals shall have crimp-on terminal lugs.
F. Wire ends and shield drain wires shall be covered with shrink tubing.
G. All cables in racks and custom panels shall be harnessed with suitable nylon tie wraps in a vertical and horizontal configuration. Cables that break out from harnesses for connection shall be provided with an adequate amount of slack cable for a service loop to provide access to equipment for servicing and adjustment.
H. All voice/data/audio/visual cabling running in free air (not in conduits) shall be rated for the environment in which the cables are installed.
I. All runs over 8 ft. to provide 2 ft. of slack cable coiled at each end of cable run.

3.06 EQUIPMENT GROUNDING

A. Bond all metallic parts to approved equipment ground.

3.07 WORK IN OTHER SECTIONS

A. The division of responsibility regarding work to be done by the Electrical Contractor and work to be done by the AV contractor shall be in accordance with the following:
B. The following work shall be the sole responsibility of the AV contractor:
C. Furnish and install all equipment, panels, and devices associated with the AV systems as indicated on project documents
D. Termination of all AV systems wiring: Coordination of AC 120-volt power and wiring within AV systems cabinet.

E. Preparation of AV shop drawings, maintenance manuals, wiring diagrams and other submittals required by the individual AV system specification sections
F. Tests, balancing, trouble shooting, adjustments and other similar work as may be required to insure complete operating AV systems
G. All AV training sessions required by these specifications
H. Any and all warranty work associated with the building audio-visual systems
I. Any other work associated with the AV systems that due to its technical nature should logically be performed by the AV contractor.
J. For all video lines confirm and document the following relevant test data:
    1. Sweep all video signal paths using a broadband noise source.
    2. Measure and record signal loss using an RF spectrum analyzer at 100, 200 and 400 MHz.
    3. Verify that signal loss at 270 MHz does not exceed 3 dB.
    4. Correct and faulty connections and retest as necessary.
K. Test all video lines using a TDR to verify:
    1. Absence of impedance anomalies due to improper connector use or installation or cable damage or shorts
    2. Proper circuit appearing at each termination location
    3. Continuity of all conductors
    4. Absence of shorts between conductors
    5. Absence of shorts between conductors and conduit
    6. Specified bandwidth is maintained
    7. Impedance is maintained
L. Documentation shall include a chart listing applicable data.
M. Provide Impedance measurements: For all permanently mounted speaker terminations, provide impedance measurement of each pair of speaker lines with all speakers connected and all amplifiers disconnected. These measurements shall be documented in a table listing impedance for each 1/3 octave band from 20Hz to 20 KHz and shall be accurate to the nearest tenth of an Ohm.
N. Create, then provide Verification Checklist for each space or system. Checklist should include all equipment indicated on project documents and may also include important items from this execution specification. Where no coax is utilized, some sweep tests may not be required.
O. Verify that all loudspeakers and mountings are free of buzzes and rattles when swept with sign wave tones throughout its rated bandwidth at normal levels.
P. Verify that correct polarity is maintained throughout the entire signal path.
Q. Verify that all equipment and systems are operating to manufacturer's specifications.
R. Verify that audio systems are free of humming, buzzing, feedback, interference, spurious oscillations, digital artifacts or extraneous noises of any kind.
S. Verify uniformity of sound coverage throughout intended coverage area. Contractor shall invite owner to attend testing sessions. Contractor to adjust sound levels in every room to meet owner's expectations.
T. Verify with consultant measurement locations, conditions and measurement criteria.
U. Verify that all equipment is operating correctly and is operating to manufacturers specifications.
V. Perform sound system rough equalization, cross over and delay settings and final sound system settings.
W. Perform all video system set up and calibration.
    1. Verify proper aiming, focus and image size for projectors.
    2. Verify proper operation of all controls.
    3. Verify brightness and correct color balance of each projected image using SENCORE CP5000 display analyzer system or equivalent.
X. Verify each installed data network cable or fiber optic cable conforms to TIA/EIA performance standards.
Y. Submit three (3) copies of a Systems Checklist or written report detailing the results of Initial Adjustments and Verification tests including all relevant drawings, charts, test instrument data and photographs. This report shall be complete and submitted to the engineer for review a maximum of five (5) days after substantial completion. With this report, submit written certification that the installation conforms to the requirements stated herein, is complete in all respects, and is ready for owner engineer final inspection and/or owner move-in.

1. Project is not complete until a Systems Checklist has been submitted. The Checklist shall identify all systems and major components required for system function. The Systems Checklist shall be filled out by contractor during systems operational testing prior to informing AE or Owner that system is complete.
2. Systems Checklist shall be presented to the Engineer prior to final punch list.
3. Provide Systems Checklist per section 27 05 00. Example of possible Systems Checklist below. Contractor shall augment or add columns and rows to this list according to what makes sense for each major system component.

Item Description	Observed Operation	Throw	Adjustments Needed	Limitations	Date Item Verified/Initials
Projector 1	Yes	Centered	Focus, tilt	None	9/10/24 R.K.
Projector 2	Yes	Max range	Bad bulb, replaced	None	9/10/24 R.K.
Speaker 1	Yes	NA	Change tap to 1W	No local volume control	9/10/24 R.K.
Speaker 2	Yes	NA	None	No local volume control	9/10/24 R.K.

Z. At Engineer request, Contractor shall be present during punch list to demonstrate function of all systems to Engineer and/or Owner.

3.08 FULL SYSTEM CHECKOUT

A. Installing Contractor's Full System Checkout
1. Installing Contractor will accomplish a complete system(s) inventory of all equipment, and inspection of all workmanship quality relating to installation details. See section 27 40 10.
2. Installing Contractor will complete all testing for system operational compliance, and test to ensure all equipment is working fully to published specifications
3. Results will be recorded and submitted to the Owner. Installing Contractor's test submittal will serve to allow 7-days for the Owner to make arrangements to do Final System Checkout.
4. A physical inventory will be taken of all equipment on site and will be compared to equipment lists in the contract documents and subsequent Installing Contractor submittals.
5. The operation of all system equipment shall be demonstrated by the Installing Contractor.
6. Both subjective and objective tests will be required to determine compliance with the specifications.
   a. The Installing Contractor shall be responsible for providing test equipment for these tests.
   b. The Installing Contractor shall be responsible for providing qualified personnel to run the tests, make adjustments, and answer system questions for as long as required to accomplish the tests and setup satisfactorily.
7. The Installing Contractor shall be responsible for providing the personnel that accomplished all programming for the system; this includes the control system, AV touch panel and any DSP software. This person will be available to run requested demonstration, make adjustments, and answer system programming questions for as long as required to accomplish the demonstration satisfactorily.
8. In the event there is required rework, large scale readjustments, or defective equipment that must be repaired or replaced, tests may be suspended or continued at the option of the Owner. Owner will advise if training can commence while any further clean-up is being done before Final System Checkout

3.09 TRAINING

A. Demonstrate to Engineer and/or owner that all individual components and all integrated systems function according to the design intent of the project documents and according to manufacturer's recommendations. Contractor shall dedicate a minimum of two (2) hours to demonstrating to Engineer/Owner the operation of each component. This is in addition (prior) to actual training sessions. This is simply to demonstrate project completion and allow Engineer to perform punch list.
1. Before scheduling such a demonstration it is the responsibility of the contractor to assure that all components and systems are functioning properly.

2. The AV contractor shall conduct group and/or individual training sessions, as requested by the Owner, for the proper operation and maintenance of the complete system.
3. Training shall provide a total of at least four hours of instruction at the site encompassing each system installed and shall orient responsible personnel to a level satisfactory to the Owner and Consultant. Training times shall be arranged with the Owner. The training shall include the facilities electrician or other designated personnel. Training shall not take place until all systems are 100% operational and Systems Checklist has been completed.
4. The Installing Contractor shall provide on-the-job training by a qualified instructor, to personnel designated by the Owner, to instruct them in the operation and routine maintenance of the systems.
5. All training shall take place after the systems are operational, but before the acceptance tests.
6. Operational Training:
   a. There shall be a minimum of four (4) hours of end-user training included in this specification for this activity.
   b. In the event the Installing Contractor does not have qualified instructors on staff for certain sophisticated equipment, the Installing Contractor, at no additional cost to Owner, will provide a manufacturer's representative for such instruction to the Owner.
7. Training Materials Supplied:
   a. System operational manual (not equipment operation manuals) that explains how to fully operate the system; from start-up to shut-down, and all operational steps in-between, in a step by step description, with pictures and other visuals to help convey information.
   b. The Installing Contractor shall video record training session(s) for Owners reference (to help limit minor follow up phone calls in the future).
8. Maintenance Training:
   a. A session with Owner's designated technical personnel for routine and preventive maintenance will be given.
      1) This training is for scheduled preventative maintenance for such items as filter and lens cleaning, minor equipment checks and "user" adjustments.
         a) This training is not meant to teach Owner's representatives how to use commercial test equipment and/or do sophisticated equipment/system alignment.
   b. There shall be a minimum of two (2) hours of end-user training included in this specification for this activity.
9. Training Materials Supplied:
   a. Utilizing the equipment manuals and flow diagrams of the required in contract closeout submittals supply a listing with suggested preventative maintenance schedule of the system equipment.
   b. Follow-up training within sixty (60) days shall also be provided.
   c. There shall be a minimum of two (2) hours of end-user training included in this specification for this activity.

3.10 FINAL CHECKOUT

A. Final Checkout will not be performed until the Installing Contractor's Full System Checkout has been successfully completed (including all "punch-list" items) and the test results have been reviewed by the Owner.
   1. Installing Contractor's test submittal will serve to allow 7-days for the Owner to make arrangements to do Final Checkout
   2. The Final Checkout with the Owner will consist of the following:
   3. A physical inventory will be taken of all equipment on site and will be compared to equipment lists in the contract documents and subsequent Installing Contractor submittals.
   4. The operation of all system equipment shall be demonstrated by the Installing Contractor.
   5. Both subjective and objective tests will be required to determine compliance with the specifications. The Installing Contractor shall be responsible for providing test equipment and qualified personnel for these tests.
   6. All final, "as-built" drawings, run sheets, manuals, and other required documents shall be on hand.
      a. Two complete sets of these documents shall be delivered to the Owner at this time..

3.11 WARRANTY

A. See General Conditions.

B. Warranty period shall be a minimum of one year. Warranty period shall commence at substantial completion or first beneficial use of system by owner, whichever comes first. During the warranty period, AV contractor shall furnish on site diagnostic and repair service to installed AV systems free of charge to owner. Contractor shall respond to service requests within 24 hours. Contractor shall provide on-site diagnostic and repair service within two business days of trouble report. Contractor shall make available after hours or weekend service at a premium rate not to exceed 1.5 times normal hourly rates minus normal hourly rates.

C. During the warranty period, the AV contractor shall provide for three service and maintenance calls by technically qualified personnel without additional charge. Calls shall be at least two hours at the site and shall be pre-arranged at least two weeks prior with the Owner

D. All tests, adjustments, or replacements shall be made in the presence of Owner's technician, or other person designated by the Owner's superintendent. Upon completion of each call a report will be provided to clearly indicate any replacements or adjustments and any evidence of tampering.

1. To maintain certain manufacturer's warranties, equipment must be installed, aligned and serviced by those installers authorized by that manufacturer to perform those duties. If the Installing Contractor is not authorized, by the manufacturer, it is the Installing Contractor's sole responsibility to make the appropriate arrangements and bear all cost and consequences
2. In cases where the manufacturer's warranty period is greater than specified in the Contract Documents, the Installing Contractor shall provide that warranty for the full extent of the manufacturer's warranty period.
3. The Installing Contractor shall exclude any labor costs incurred by removing and re-installing the defective items after the system's one-year warranty.
4. In cases where the manufacturer's warranty period is less than 12 months, the Installing Contractor shall warrant the system(s) in accordance with the Contract Documents (See below).
5. * Optional* The system warranty shall include a minimum of four (4) preventive maintenance visits, to perform operation checks of the equipment, screens, projector lenses and other critical surfaces, to lubricate moving parts as recommended by the respective manufacturers and to adjust and align projector to maintain optimum registration and focus.
6. All manufacturers' equipment warranties shall be activated in the Owner's name and shall commence on the date of Substantial Completion.
7. In the case of Installing Contractor-modified equipment, the manufacturer's warranty is normally voided. In such cases, the Installing Contractor shall provide the Owner with a warranty equivalent to that of the original manufacturer.
8. In the event of malfunction or failure of any audiovisual equipment provided by the Installing Contractor, the Installing Contractor shall be responsible for replacement of faulty equipment, or providing "loaner" equipment at no cost to the Owner for the duration of the repairs. In the event that "loaner" equipment is provided, said equipment shall meet or exceed the original equipment's specifications until the original equipment is replaced.
9. In cases where the Installing Contractor is providing and installing audiovisual equipment and/or hardware to be integrated with equipment furnished by others, it shall be the responsibility of the Installing Contractor to warrant their equipment as described in the Contract Documents unless said equipment shows misuse and or abuse by others during re-installation or connection of equipment by others.
10. Telephone Support
11. The Installing Contractor shall respond via telephone within two (2) hours to any request for service.
12. This first contact should outline the nature of the problem or functional anomaly.
13. The Installing Contractor shall make available personnel knowledgeable with the installed system who can address specific system issues described by the system operators.
14. Telephone support shall be available between normal business hours, Monday through Friday.
15. On-Site Support
16. The warranty shall be an "on-site" warranty, with a twenty-four (24) hour response time.
17. Warranty period shall be a minimum of one year. Warranty period shall commence at substantial completion or first beneficial use of system by owner, whichever comes first. During

the warranty period, AV contractor shall furnish on site diagnostic and repair service to installed AV systems free of charge to owner. Contractor shall respond to service requests within 24 hours. Contractor shall provide on-site diagnostic and repair service within two business days of trouble report. Contractor shall make available after hours or weekend service at a premium rate not to exceed 1.5 times normal hourly rates minus normal hourly rates.

18. During the warranty period, the AV contractor shall provide for three service and maintenance calls by technically qualified personnel without additional charge. Calls shall be at least two hours at the site and shall be pre-arranged at least two weeks prior with the Owner
19. These service and maintenance calls shall be in addition to any warranty required service calls and shall commence every 4 months after the date of final acceptance by the Owner.
20. All tests, adjustments, or replacements shall be made in the presence of Owner's technician, or other person designated by the Owner's superintendent. Upon completion of each call a report will be provided to clearly indicate any replacements or adjustments and any evidence of tampering

END OF SECTION

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SECTION 27 42 20
DIGITAL SIGNAGE SYSTEM

PART 1 - GENERAL

1.01 RELATED WORK
A. Section 27 05 00 – Common Work Results for Communications Systems
B. All references including Division 26 apply.

1.02 REFERENCE STANDARDS
A. The Work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and sections under Division 1 General Requirements.
B. FCC Rules and Regulations - Part 15, Subpart J.

1.03 SUBMITTALS
A. Shop drawings for equipment provided under this Section. Shop drawings shall include:
   1. Outline drawings of equipment showing overall dimensions, power, control and signal wiring.
   2. Termination drawings and one-line Audio-Visual drawings showing all equipment and room numbers. One-line drawings to indicate equipment connections with all parts, equipment, cables and interface (connection) types.
   3. Literature describing in detail equipment proposed.
   4. Complete review of this specification, noting for each paragraph whether or not proposed equipment complies with project specifications or deviates in some fashion. Include justification for each deviation proposed.

1.04 WARRANTY
A. Contractor shall warranty all materials, electronic equipment, system function and labor for one year after installation. Warranty shall include service, complete replacement or repair of products as required to maintain system function.

1.05 DESCRIPTION
A. Provide materials and labor for cables, connectors and faceplates to connect digital signage player into AV equipment rack location on floor plans. There will be two players at the AV equipment rack location. Contractor to coordinate with Owner the owner supplied computer to load and operate the digital signage software needed to operate and schedule the content to be displayed.

PART 2 – PRODUCTS

2.01 PRODUCTS
A. Refer to project documents for product recommendations.
B. Manufacturers may include NovoDS, BrightSign, Extron, Crestron or equivalent.
C. Products to include:
   1. 8-port broadcaster
   2. Remote receivers
   3. Patch cables and connectors as required for compete functioning system
   4. OFE computer running a Windows compatible version operating system to run the digital signage software.
      a. 1920 x 1080 resolution is required at each digital signage display. Adjust submitted parts list to accommodate this resolution.
      b. Audio is not required at each signage display but coordinate with Owner. Adjust submitted parts list to accommodate this requirement.
      c. Intent is to use standard Category 6 cabling for distribution. Do not submit products that require use of non-skew cable.
   5. TV monitors provided by owner

PART 3 - EXECUTION

3.01 GENERAL

A. System shall be installed per project documents and per manufacturer's recommendations.
B. Cable shall comply with building and fire codes. Use plenum rated cable where required.
C. A fully-functioning, complete working system shall be provided.
D. Create and utilize System Checklist per section 27 05 00.

3.02 INSTALLATION

A. Install system in accordance with manufacturer's recommendations.
B. System wiring shall be environmental air plenum approved conductors.
C. Wiring shall be placed in communications cable trays or supported from building members and suspended ceiling wires by listed devices.
D. Cables installed in exposed areas, i.e., mechanical rooms, shall be enclosed in conduit.
E. Cables shall be continuous and free of splices. Cat 6 cable and patch panels to be provided under another specification section.
F. Shields shall be bonded to their respective amplifiers only after determining that no shorts exist between conductor wires and/or external shield.
G. Wires terminated at terminal blocks shall have crimped type or soldered connections.
H. Final connections and equalizing of systems shall be made by factory trained personnel.
I. System wiring shall be environmental air plenum approved conductors.
J. Provide Broadcaster, remote receivers, patch cables and connectors.
K. Verify field pathways, conduits and confirm actual cable length prior to ordering.
L. Coordinate with owner regarding final position and placement of the two digital signage displays.
M. Cat 6 UTP at each location provided by Div. 27 15 10 contractor.
N. Coordinate with electrical contractor or owner as required to confirm locations of all equipment, including location of owner-provided PC for content control.
O. Coordinate with owner for their provision of commercial grade TV monitors having HDMI input.

3.03 FUNCTION

A. System shall be provided to allow owner to display one image from one source on up to 8 different TV monitors in different locations.
B. Sound (audio) is not required at TV monitors
C. 1920 x 1080 resolution is required at each TV monitor.
D. Head-end PC and viewing monitor to be located in lower level IT office.
E. Intent is to use standard Category 6 cabling for distribution. Do not submit products that require non-skew cable.

3.04 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Contractor shall provide 3 sets of complete instruction manuals, service manuals, schematics, parts lists, recommended spare parts lists, and the selected equipment vendors service centers.
B. Contractor shall provide to the Owner a working system that will provide Owner with templates to build their own working digital signage display at substantial completion.

3.05 TRAINING

A. Included in bid, Audio-Visual system supplier shall provide training for Owner's personnel on operation and maintenance of each sound system component and total system. Training shall be pre-arranged with owner. Training shall be the equivalent of one full day, or 8 hours training shall be complete to enable personnel to perform associated tasks and functions.
B. Training shall be conducted during normal business hours after system start-up and Owner acceptance. Training shall be scheduled with owner within 10 days of substantial completion or as negotiated with owner.

END OF SECTION

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SECTION 27 51 13
OVERHEAD PAGING/SOUND SYSTEM

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Base Bid
   1. Contractor Provide:
      a. Complete, functioning audio system for distribution of multiple audio sources to multiple locations.
      b. Transmit live voice to overhead speakers in various offices and public areas as indicated on drawings.
      c. Amplification and distribution equipment to receive dual source input from head end, telephone system or owner's audio source to distribute to speakers in multiple zones or locations.
      d. Ceiling mounted, wall mounted and outside rated horn speakers as indicated on project documents.
      e. All cabling, mounting devices, supports, arms, coverings, volume controls, amplifiers, zone controllers, telephone interfaces and other equipment as recommended by manufacturer and as required for complete functioning.
      f. Coordinate with owner for connection to existing audio distribution equipment, emergency notification source or to phone system. This contractor to provide all patch cords necessary to make final connections and patches to all other systems as required by owner for complete functioning and integration with other systems.
      g. Coordinate with Electrical Contractor to provide power were required.

B. Alternate Bid
   1. Contractor provide alternate unit bid price to:
      a. Add or delete one standard ceiling speaker which includes any length of cable (use an average), connection to appropriate zone and amplifier, testing and volume adjustment.
      b. Add or delete one standard wall mount volume controller.

1.02 DESIGN INTENT

A. Overhead speaker/paging system for entire building
B. Minimum two inputs
   1. Telephone system input or stand-alone microphone input for voice paging
   2. Optional music input
C. Output
   1. One source input for entire building
   2. Different areas or rooms do not require distinct inputs
   3. Different areas or rooms DO require individual volume controls to permit users granular volume control of each area. These areas or “volume zones” are identified on plans
   4. Speakers in old/existing building may home run cable to existing telecom area in Boiler 151 or cables may home run to new telecom room 130. Provide separate and/or sufficient amplifiers/wattage to power all areas as needed.
D. Design
   1. System is intended be to 70V but a 24V (Valcom) system is also acceptable.

1.03 SECTION INCLUDES

A. Page/Zone Control
B. Telephone/Page Interface
C. Amplifier/Power Supply
D. Speakers
E. Transformers
F. Ceiling Grilles
G. Wall Grilles

H. Back Boxes and Support
I. Volume Control
J. Cable
K. Cable Management

1.04 RELATED WORK

A. Section 27 05 00 - Common Work Results for Communications Systems
B. All references including Division 26 apply.
C. The Work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and sections under Division 1 General Requirements.

1.05 SUBMITTALS

A. Submit shop drawings for equipment provided under this Section per section 01 - Administrative Requirements.
B. Page/Zone Control
   1. Telephone/Page Interface
   2. Amplifier/Power Supply
   3. Speakers
   4. Transformers
   5. Ceiling Grilles
   6. Wall Grilles
   7. Back Boxes and Support
   8. Volume Control
   9. Cable
   10. Cable Management
   11. Outside Rated Horns
C. Shop drawings shall include:
   1. Outline drawings of equipment showing overall dimensions, power, control and signal wiring.
   2. Termination drawings, wiring diagrams and one-line Paging System riser drawings showing all equipment and head end room numbers.
   3. Literature describing in detail equipment proposed and all operating modes.
   4. Complete review of this specification, noting for each paragraph whether or not proposed equipment complies with project specifications or deviates in some fashion. Include justification for each deviation proposed.
D. Submittals shall be grouped with related systems
E. Submit catalog sheets or photocopies. Do not submit hard copies of web pages. Web pages change frequently and will be rejected.
F. Circle noted item with black pen or use arrows that can be copied.
G. At end of project submit record documents, as-builts, certificates, warranties and other operational manual documents to assist owner to maintain all systems.
H. Work shall not proceed without Engineer's approval of submitted items. Materials that are installed without Engineer approval risk forced removal by contractor at Engineer request.
I. Shop Drawings:
   1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.

1.06 GUARANTEE

A. System and components shall be guaranteed free from defects in workmanship and materials for a period of 1 year from date of acceptance by Owner. During guarantee period, manufacturer shall perform services necessary on the System, and supplier shall provide annual inspections, written reports to Owner detailing findings of each inspection, and documentation of action(s) taken to remedy abnormal conditions.

1.07 PERFORMANCE TESTING

A. System shall be fully tested for complete operation.
B. Speaker volume shall be adjusted with owner present to confirm volumes are acceptable to owner.

C. System shall be tested with all other ancillary or attached systems functioning and integrated with the overhead page system including phone system, emergency notification system, audio-visual system or other systems as noted in this specification or on project documents.

1.08 DEFINITIONS

A. FCC – Federal Communications Commission
B. System – Overhead Page and Sound System including all required components
C. V – Volt
D. VoIP – Voice over Internet Protocol
E. W - Watt

1.09 FCC COMPLIANCE

A. Equipment furnished under this contract shall have been tested and made to comply with limits for Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against interference when operated in commercial environment. Literature shall so note and equipment shall be so labeled to show this compliance.

1.10 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Contractor shall furnish to Engineer, upon completion of work, but before final acceptance of system, 3 bound typewritten copies of instructions covering complete maintenance and operation of system and complete set of as-built drawings. Contractor shall instruct owner on care, operation, and maintenance of all parts of system.
B. In addition to complying with Div. 26 - General Electrical Requirements, Contractor shall provide 3 sets of complete instruction manuals, service manuals, schematics, parts lists, recommended spare parts lists, and current list of local manufacturer approved service centers.

1.11 OWNER TRAINING

A. Page System supplier shall provide training (1 hours minimum) for Owner's personnel on operation and maintenance of overhead page system. Training shall be complete to enable personnel to perform associated tasks and functions in competent and skillful manner. Training shall be conducted during normal business hours after system start-up and Owner acceptance.

PART 2 – PRODUCTS

2.01 MANUFACTURER

A. Atlas, Quam, QSC, Bogen, Valcom, Crestron, Lowell or system of similar quality and function
B. 70 volt system
C. Components shall be UL listed for their function and installation, except as otherwise noted.
D. Atlas Atmosphere

2.02 PAGE/ZONE CONTROL

A. Minimum (4) zone output, level control for all zones
B. Minimum one zone per floor
C. (zones shown on documents are only for volume control, not for distinct inputs/outputs)
D. Expansion slots
E. Universal telephone interface
F. Two background music inputs
G. Flexible software programming for zone output
H. 2, 3, 4, 5 digit dialing plans
I. One-way paging
J. 150 speaker drive capacity per zone
K. Override input
L. Contact and 90V night ring inputs
M. DTMF (dual-tone multi-frequency) programmable
N. FCC part 68 registered

2.03 TELEPHONE/PAGING INTERFACE

A. Telephone/page interface to accept input from analog or digital telephone system
B. Ability to connect to telephone page port to receive voice input from telephone system and distribute over paging system
C. Confirm with owner if unique VoIP digital interface is required before purchasing products

2.04 AMPLIFIER, POWER SUPPLIES

A. Provide equipment as noted on project documents. Audio source provided by owner.
B. Amplifier(s) may assume power as required for 1 Watt per speaker plus 50% spare capacity
C. Amplifiers to be provided on every floor or at every wiring head end location, or as required by manufacturer and/or good design principles
D. Contractor to provide sufficient power amplifiers/wattage to provide for 72dB-SPL at 72" AFF when amplifiers and wall volume controls area set at 12 noon or center position. This should allow ability to turn up volume if needed. Zero level on volume control should have zero sound output.
E. 35W to 250W as required by speaker count
F. Capable of handling 70V, 25V, 8 Ohm or 4 Ohm speaker loads
G. Rack mountable. (wall mount is acceptable)
H. Signal-processing insert to allow external equipment to be inserted between pre-amp output and power amp input.
I. Bass and treble controls
J. Four module bays to permit insertion of a variety of modules
K. Provide modules as required for system function and integration with other systems

2.05 SPEAKERS

A. 70 V, 8" round
B. Average sensitivity: 95 dB, sound pressure level (SPL) 1W/1M
C. Power rating: 20W RMS, EIA 426A standard
D. Calculated output: 108 dB, 20W, 1M
E. Magnet type: BeFe Ceramic, 10oz.
F. Frequency Response: 40Hz – 18 kHz per EIA 426A standard
G. Nominal coverage angle: 90 degrees included angle, -6dB /2 kHz, half space
H. Mounting: (4) x 3/8 holes spaced 90 degrees apart on 7-5/8" circle
I. Audio connection: 0.205" spade lug
J. Similar to Altas SD72W

2.06 TRANSFORMERS

A. 70 V, 10 W
B. Constant voltage line transformer
C. (5) Multi-tap outputs
D. Insertion loss: 0.75 dB
E. Secondary load: 8 Ohm
F. Frequency response: 50 Hz – 20 kHz
G. Connections: 12" color-coded, pre-cut
H. Similar to Quam TCH70

2.07 CEILING GRILLES

A. Similar to Quam BR8-2WS
B. 16 gauge steel
C. Outside diameter: 10-1/2"
D. Mesh: 24 gauge steel mesh grille insert
E. Four welded 8-32 x 1/1/4" studs on back
F. Finish: White baked epoxy

2.08 WALL GRILLES

A. Similar to Quam BS8WS
B. 22 gauge steel

C. Outside dimensions: 11-1/2" square
D. Square perforated hole pattern
E. Four welded 8-32 x 1" Phillips truss head mounting screws
F. Finish: White baked epoxy

2.09 BACKBOXES AND SUPPORT

A. Back box for ceiling mount:
   1. Flush mounted, round
   2. Material: Steel
   3. Polystyrene dampening pad fitted to inside top
   4. Finish: White baked epoxy
   5. Size:
      a. Height: 4-1/2"
      b. Max. flange diameter: 12-5/16"
      c. Bottom diameter: 9-3/4"
      d. Top diameter: 8-1/2"
      e. Internal displacement: 275 cu. in.
      f. Also required: Ceiling bridge support similar to Quam SSB-2
   6. Similar in quality to Quam ERD-8
B. Back box for wall mount:
   1. Flush mounted, square
   2. Material: steel
   3. Acoustic foam liner
   4. Finish: White baked epoxy
   5. Size:
      a. Depth: 3-3/4"
      b. Width/height: 10-3/4" square
      c. Baffle attachment: (4) x #8 Tinnerman clips
      d. Electrical Access: (4) x ½" - 3/4" conduit knock-outs each side
   6. Similar in quality to Quam ES-8

2.10 CABLE

A. Speaker cable from head-end to volume controls or speakers
   1. Conductors: 2
   2. Gauge: 16 or 18 as noted on project documents (18 gauge if not noted)
   3. Jacket: PVC, riser rated, shielded (or plenum rated as required by environmental plenum)
   4. Or as recommended by manufacturer of System
   5. Where two signals are sent from amplifier to speakers, each pair of conductors must be individually shielded, or run separate cables

2.11 CABLE MANAGEMENT RACEWAY

A. Plastic or metallic type with fingers
B. Small innerduct or "smurf tube", spiral wrap and cable ties as required
C. J-hooks or cable tray in ceilings

PART 3 - EXECUTION

3.01 GENERAL

A. Provide speakers and volume controls at locations noted on drawings.
B. System shall be installed per project documents and per manufacturer's recommendations.
C. Cable shall comply with building and fire codes. Use plenum rated cable where required.
D. A fully-functioning, complete working system shall be provided.
E. Create and utilize System Checklist per section 27 01 00.

3.02 INSTALLATION

A. Install system in accordance with manufacturer's recommendations. System wiring shall be riser or plenum rated conductors as approved by local codes and installation practices. Wiring shall be placed in communications cable trays or supported from building members using j-hooks, threaded bridle rings, or equal assemblies).
B. Cables shall be continuous from first (closest) speaker to telecom room and free of splices.
C. Speakers on same floor may be daisy-chained per manufacturer's instructions. Daisy chain splices shall be made only in accessible locations at or near ceiling speakers or within volume control back box. Do not splice cables mid-run at locations other than at speakers or within back boxes. All splices and terminations must remain accessible.
D. Refer to project documents for cable riser and connection diagram.
E. Cables installed in exposed areas, i.e., mechanical rooms, shall be enclosed in conduit.
F. Final connections and equalizing of systems shall be made by experienced personnel.
G. Provide hinged cover wiring duct on telecom room wall to manage cables from floor and ceiling to amplifier location.
H. Provide all cables as indicated on project documents and as recommended by manufacturer. The fact that certain cables may not appear on project documents does not relieve contractor of the responsibility to provide all required cables and connections for a fully functioning system.
I. Provide speakers where indicated on drawings or as indicated by owner.
J. Coordinate speaker location with other utilities and services in ceiling space and ceiling tiles.
K. Speakers should be located near center of room, center of hallway or towards desk locations if in offices or conference rooms.
L. Connect speaker wire from volume control in each room using appropriate tap value - as required by amplifier capacity and number of speakers.
M. Goal is for sound meter to read 72 dB-SPL (plus or minus 2 dB) at 72" AFF directly under each speaker when volume control is set at center, 12 noon position.
N. Provide faceplates with volume control where (if) required.
O. Provide flush, in-wall speakers in areas where ceiling is not available for ceiling speakers.
P. Provide desk mount speakers where neither ceiling nor walls are available for speaker mounting. Every attempt has been made to indicate locations on project documents where desk mounted speakers are required. When in doubt, consult with owner.
Q. Refer to project documents for connection diagrams.
R. Coordinate with owner for access to Ethernet, telephone or AV network.

3.03 LABELING

A. ALL Cables in telecom room shall be LABELED indicating floor of destination and location of zone. Label cables according to room number of first office or hallway in line to be connected. Also label as to which TR cable is home run. Labels shall be permanently affixed to cable sheath approximately 12" from end termination at amplifier. Labels may have to be replaced or relocated to comply with this requirement after amplifier is installed.
B. Provide cable label on cable sheath 12" from first office ceiling speaker or where cable enters conduit down to volume control. Label to indicate head-end location (telecom room number and floor) as well as indication of "HEAD-END" to indicate cable run is first in line. If volume controls are not required, provide label near speaker location in ceiling.
C. At every successive ceiling speaker, provide label indicating office number of next office in line away from and towards head end. Each label shall indicate the "to" and "from" location for the next office or hallway in line.
D. Example:
    1. Cable from first floor telecom room 108 runs to hallway 1018. Where cable nears ceiling speaker to provide label reading as follows:
        a. "To TR 108" on end towards TR 108
        b. "To hall 1018, speaker 2" on end towards next speaker in line
        c. At Head end, cable label to read "to hall 1018, speaker 1"
        d. Zone numbering should also be noted if zones are required (zone 1, zone 2, etc.)

3.04 TRAINING

A. Contractor shall conduct one on-site, hands-on user training sessions, limited to 4 people for one hour. This training will be necessary for all users of the system as determined by the Owner. Contractor shall provide one (1) additional hour of training within sixty days of cutover with no additional charges to the owner. Contractor shall be available by telephone at no additional charge for up to one (1) hour per month for three (3) months following installation to discuss issues with the system.
B. Training shall include overview of cable routing, terminations, labeling, volume control and toggle switch installation, head-end cable routing and amplifier connection.

3.05 TESTING

A. Contractor shall be responsible for supplying test equipment and qualified personnel to conduct acceptance tests.
B. Goal is for sound meter to read 72 dB-SPL (plus or minus 2 dB) at 72" AFF directly under each speaker when volume control is set at center, 12 noon position.
C. Contractor shall conduct system tests as specified by manufacturer upon completion of installation. Contractor shall test cables and dual input for each floor. Contractor shall provide temporary amplifier and dual input signals in order to test system, or shall return to site once owner has provided amplifier and dual input signal.
D. Contractor shall conduct tests during course of construction when identifiable portion of installation is complete. Alternatively, testing can be conducted after entire installation is complete if this does not delay the project schedule or affect system functionality.
E. Contractor shall verify acceptable volumes with owner. Notify owner prior to testing so that owner may accompany contractor to verify appropriate volumes. Make adjustments as required at amplifier or tap settings on speakers.
F. It is recommended that Contractor obtain written statement from owner that all speaker volumes have been adjusted to owner's preferences. Contractor shall be liable and responsible to return to site to adjust volumes if volumes are not adjusted to owner's satisfaction prior to project completion.
G. If tests fail to meet stated specifications, make such adjustments, replacements and changes as are necessary and then repeat tests which disclosed faulty or defective material, equipment or installation method. Provide labor and materials for testing at no additional cost to Owner. The system must complete a successful performance period. The performance period will begin on the day following the completed installation and must continue for 30 consecutive days during which time the system will operate at an average effectiveness level of 99 percent or more. If for any reason this level cannot be maintained, a new 30-day performance period will be initiated. It is not necessary that one 30-day period expire before another performance period begins.
H. DOCUMENTATION
   1. See section 27 01 00 for requirements.

END OF SECTION

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SECTION 28 13 00
ACCESS CONTROL

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Contractor to provide a fully functional access control system that allows access to owner determined doors within and outside of the building.
   1. All devices, equipment, control panels, cabling, connections and terminations to support the function of access control.
   2. If so desired by the owner, full integration with other systems including Video Surveillance, and Security System.
   3. Verify prior to bid that all power requirements and network access are coordinated with Electrical Contractor.
   4. Provide ProdataKey (PDK) system to integrate with existing systems

1.02 SECTION INCLUDES

A. Card/FOB Readers
B. Reader Controllers
C. Request to Exit Sensors
D. Door Position Switches
E. Security Access Operating System and Application Software
F. Integration with Other Systems (CCTV, Elevators)
G. Cables

1.03 RELATED WORK

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
B. Section 27 05 00 – Common Work Results for Communications Systems
C. All references, including Division 26 and 27 apply.

1.04 SUBMITTALS

A. Submit Shop drawings for equipment under this section per section 01 30 00 - Administrative Requirements.
   1. Reader Controller
   2. Request to Exit Sensor
   3. Door Position Switch
   4. UPS and Battery Back-up System
   5. Networked Workstations
   6. Operating Systems
   7. Application Software
   8. Integration Systems software and other information
   9. Cables
B. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Reference each product to a location on Floor Plan Drawings.
C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. Diagrams for cable management system.
   2. System labeling schedules, including electronic copy of labeling schedules that are part of the cable and asset identification system of the software specified in Parts 2 and 3.
   3. Wiring Diagrams. For power, signal, and control wiring. Show typical wiring schematics including the following:
      a. Individual door types – cabling diagrams
      b. Network diagrams for workstation, central stations and control points
   4. Cable Administration Drawings: As specified in "Identification" Article.
   5. Battery and charger calculations for central station, workstations, and controllers.

6. Badging station, and printer information.

D. Field quality-control reports.

E. Operation and Maintenance Data: For security system to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
   1. Microsoft Windows software or other type of Operating System Software documentation.
   2. PC installation and operating documentation, manuals, and software for the PC and all installed peripherals. Software shall include system restore, emergency boot CDs, and drivers for all installed hardware. Provide separately for each PC.
   3. Hard copies of manufacturer's specification sheets, operating specifications, design guides, user's guides for software and hardware, and PDF files on CD-ROM of the hard-copy submittal.
   4. System installation and setup guides with data forms to plan and record options and setup decisions.

F. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Credential card blanks, ready for printing. Include enough credential cards for all personnel to be enrolled at the site plus an extra 50 percent for future use.
   2. Fuses of all kinds, power and electronic, equal to 5 percent of amount installed for each size used, but no fewer than three units.
   3. Pre-written CD with all programming written to reconfigure a spare work station if required by project and owner.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
   1. Cable installer must have on staff a Registered Communication Distribution Designer certified by Building Industry Consulting Service International.
   2. Cable installer must be a certified ITS Installer 1 minimum certified by Building Industry Consulting Service International.
   3. Contractor is required to submit certification information with submittals.

B. Source Limitations: Obtain central station, workstations, controllers, card readers, and all software through one source from single manufacturer.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NFPA 70, "National Electrical Code."

1.06 DELIVERY, STORAGE AND HANDLING

A. All Parts:
   1. Store in temperature- and humidity-controlled environment in original manufacturer's sealed containers. Maintain ambient temperature between 50 and 85 deg F (10 and 30 deg C), and not more than 80 percent relative humidity, noncondensing.
   2. Open each container; verify contents against packing list; and file copy of packing list, complete with container identification, for inclusion in operation and maintenance data.
   3. Mark packing list with the same designations assigned to materials and equipment for recording in the system labeling schedules that are generated by software specified in "Cable and Asset Management Software" Article.
   4. Save original manufacturer's containers and packing materials and deliver as directed under provisions covering extra materials.

1.07 PROJECT CONDITIONS

A. Environmental Conditions: System shall be capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:

PART 2 – PRODUCTS

2.01 SYSTEM

1. Manufacturer: ProdataKey (PDK

a. Subject to the requirements of this specification, provide a complete functioning system by PDK in order to integrate with existing city/library systems.

b. Provide all system access control software and related hardware as standard catalog product offering of a single manufacturer.

c. Exception: Controlled devices, such as electric locks, door actuators, sensors, etc., are specified elsewhere.

d. System software shall be installed on owner furnished computer in Library Director's Office.

2. Description

a. The system is a card-reader security system to control access to buildings.

b. Utilizes a System Controller and related peripherals.

c. Provides management, control, and monitoring of access and alarm components.

d. Setup and configuration of system application and database.

2.02 MAINTENANCE AND ADMINISTRATION OF ACCESS CONTROL

A. INSTALLERS

1. Contractor requirements:

a. Local installation and service organization.

b. Provide satisfactory evidence of liability insurance and Workmen's Compensation coverage for employed personnel as required by law.

2. Ensure that all personnel working on the project are registered with the state or local jurisdiction licensing board as provided for by current state or municipal statutes.

a. At time of bid, the contractor shall be licensed by the state or local jurisdiction to perform security work within the state.

b. Contractors who have security licenses or permits pending shall not be considered acceptable for bidding on this project.

3. Installer and technician requirements:

a. Must be experienced and qualified to accomplish all work promptly and satisfactorily.

b. Provide proof that designated service and support personnel have successfully completed the appropriate manufacturer offered hardware and software training and certification for installation, service and maintenance of the specified system.

c. Advise owner in writing of all designated service and support personnel responsible for installation as well as pre and post warranty service.

B. EXAMINATION

1. Inspect the installation site prior to bidding the job.

2. Report any discrepancies between the project specification and bid documents and the site examination prior to the bid opening date.

C. PREPARATION

1. Order all required parts and equipment upon notification of award.

2. Bench test all equipment prior to delivery to the job site.

3. Verify the availability of power where required. If a new source of power is required, a licensed electrician shall be used to install it.

4. Verify the availability of communication infrastructure where required.

5. Arrange for obtaining all programming information including access times, free access times, door groups, operator levels, etc.

D. INSTALLATION

1. Requirements

a. Install all system components and appurtenances in accordance with the manufacturer's specifications, referenced practices, guidelines, and applicable codes.

b. Furnish all necessary interconnections, services, and adjustments required for a complete and operable system as specified.
c. Control signal, communications, and data transmission line grounding shall be installed as necessary to preclude ground loops, noise, and surges from adversely affecting system operation.
d. Carefully follow the instructions in the manufacturers' installation manual to ensure all steps have been taken to provide a reliable, easy to operate system.
e. Perform all work as indicated in the project specifications and bid documents.
f. Pre-program system and load onto owner's host computer.

2. Systems Integration
   a. Coordinate with the owner's IT Department prior to connecting to the owner's network.
   b. Work in harmony with all other trades.
   c. Integrate related system and sub-systems.

E. QUALITY CONTROL
1. Workmanship
   a. Comply with highest industry standards, except when specified requirements indicate more rigid standards or more precise workmanship.
   b. Perform work with persons experienced and qualified to produce workmanship specified.
   c. Maintain quality control over suppliers and subcontractors.
   d. Quality of workmanship is considered important. Owner's representative will have the authority to reject work which does not conform to the project documents.
2. Site Tests and Inspections
   a. Execute adequate testing of the system to insure proper operation.
   b. Upon reaching Substantial Completion, perform a complete test and inspection of the system. If found to be installed and operating properly, notify [Client] of your readiness to perform the formal test and inspection of the complete system.
   c. Submit the Record Drawings (as-builts) to owner's representative for review prior to inspection.
   d. During the formal test and inspection (commissioning) of the system, have personnel available with tools and equipment to remove devices from their mounts to inspect wiring connections. Provide wiring diagrams and labeling charts to properly identify all wiring.
   e. If corrections are needed, the contractor will be provided with a punch list of all discrepancies. Perform the needed corrections in a timely fashion.
   f. Notify owner when ready to perform a re-inspection of the installation.
3. Software Engineering Support
   a. Provide software engineer services to assist the owner in coordinating the interfaces between the security management system and the staff databases or other remote systems.
   b. Software engineer shall be certified by or employed by the system manufacturer, and shall be thoroughly knowledgeable of the system applications.
   c. Software engineer shall be on-site and available to meet with owner's representatives for a period of not less than two consecutive days. On-site visit shall be scheduled at the convenience of the owner.

F. SYSTEM STARTUP
1. Provide initial programming and configuration of the security management system.
2. Programming shall include defining hardware, doors, monitor points, clearance codes, time codes, door groups, alarm groups, operating sequences, camera call-ups, etc. Input of all program data shall be by contractor. Consult with owner's representative to determine operating parameters.

3. Owner, with the cooperation and assistance of contractor, will input the cardholder data for each access card.
4. Maintain hard copy worksheets which fully document the system program and configuration
   a. Worksheets shall be kept up to date on a daily basis until final acceptance by owner.
   b. Worksheets shall be subject to inspection and approval by owner.
   c. Provide final copies to owner prior to project close-out.
5. Maintain a complete, up-to-date backup of the system configuration and cardholder database.
   a. Backup shall be maintained throughout programming period until final acceptance by owner.
   b. Submit back-up media to owner upon Final Acceptance.
6. Provide follow-up assistance with system configuration sixty (60) days after start-up of system as requested by owner. Include a labor allowance for follow-up assistance in base bid price.
7. Training
   a. Provide system operations, administration, and maintenance training by factory trained personnel qualified to instruct.
      i) Training shall be oriented to the specific system being installed under this contract as designed and specified.
      ii) Provide training sessions at owner's facility, and schedule at the owner's convenience.
      iii) Provide written training outline and agenda for each training session prior to scheduling.
      iv) Record and provide copies of training programs for owner knowledgebase.
   b. Owner will designate personnel to be trained.
      i) Provide classroom instruction for people selected by owner.
      ii) Provide two (2) hours of individual hands-on training for each person.
         a) Hands-on training shall include the opportunity for each person to operate the system.
         b) Hands-on training shall include practice of each operation that an operator would be expected to perform.
      iii) Provide printed training materials for each trainee including product manuals, course outline, workbook or student guides, and written examinations for certification.
   c. Cover all operating features of the system, including the following:
      i) System set-up and cardholder database configuration.
      ii) Access control features.
      iii) Alarm monitoring features.
      iv) Report generation and searches.
      v) Card management.
      vi) Database backup procedures.
      vii) Routine maintenance and adjustment procedures.

Schedules for Access Control

A. Schedules:
   1. Support up to a fixed number of time schedules
   2. Each schedule can define one or more weekly time intervals, and one or more Holiday Groups

Access Control Global Applications

A. System Architecture:
   1. Web-based application integrating multiple security functions including management, control, and monitoring of:

   a. Access control
   b. Alarm management
   c. Video surveillance interface
2. Operational on the Windows 7 and 10 (32-bit or 64-bit)
   a. Multi-user capability
3. Standard Transmission Control Protocol (TCP/Internet Protocol (IP) networking communication protocol between client workstations, video surveillance system(s) and database subsystems
   a. Support 10/100/1000 MB Ethernet connectivity over Local Area Network (LAN)/Wide Area Network (WAN) network typologies
4. Support Dynamic Host Configuration Protocol (DHCP) or fixed IP address
   a. System Controller shall provide solutions to be programmed either in DHCP or fixed IP address
5. Support network configuration
6. System Controller supports Network Time Protocol (NTP)
7. Support Secure Socket Layer (SSL)-encrypted communications between the Web browser client and the System Controller
8. Support Advanced Encryption Standard (AES)-encrypted communications between the System Controller and door controllers
9. Support the ability to create Certificate Signing Requests (CSR), and import signed certificates, or generate and install self-signed certificates
   a. Fully Qualified Domain Name (FQDN) or SSL can be used in certificates
10. Shall automatically adjust for Daylight Saving Time (DST) (if the selected World Time Zone supports DST)
11. Reader Interface
   a. Controller only supports Wiegand interface
   b. Reader interface between controller and reader must be Wiegand
12. Support up to ten (10) user-defined personnel fields
13. Support up to 100 person photos in GIF, JPG, and PNG format
   a. Photos up to 200 KB in size can be uploaded
   b. Photos are automatically resized to 10 KB or less
   c. Total photo storage size: 40 MB
14. Support viewing of the most recent 65,535 events
15. Support extended door strike and door held times for ADA requirements
   a. Option to enable or disable extended times is defined on a per credential basis
   b. Extended time durations are defined on a per door basis
16. Allow current system settings and data to be saved as custom settings
17. Support auto-discovery of panels and downstream modules
18. User Wizards
   a. Provide step-by-step guidance for certain common user tasks
19. Event and Person Search
   a. Support search (filtering) of records
20. Shall allow user to create a new record based on an existing record
21. Support tooltips when user hovers over certain user interface elements
22. System status indicator
   a. Shall be visible from any screen
23. Support generation of reports

Access Control Software

A. Access Control Management:

1. Monitor all secured areas and initiate alarm notification when reader-controlled doors are breached
2. Allow secured doors to open without generating an alarm condition upon:
    a. Valid card read and/or PIN entry
    b. Exit request using egress device
    c. Manual unlocking of door via authorized remote command
3. Events
    a. Shall allow for the viewing of events which have occurred on the system
    b. Access Granted, Access Denied, Access Granted – Door Unlocked, and Access Denied – Door Locked
    c. Shall list the cardholder who initiated the event along with the time that the event occurred, event description, device, date/time (in format of language pack), and photo if available
    d. View and sort events
    e. Export events in sorted order
    f. View events based on door activity
    g. Shall support filtering of events
    h. Localization of event-related text into System Language
4. Normal Grant Access Time
    a. Amount of time a door temporarily opens when access is granted
5. Extended Grant Access Time
    a. Amount of time a door temporarily opens when a person has Use extended strike/held times enabled on their badge
6. Open Time
    a. Amount of time that a door is open after a Request to Exit (RTE) event occurs
7. Suppress door strike functionality
    a. Allows administrator to prevent the door strike from energizing when the RTE contact closes
8. Held Time
    a. Amount of time that a door can remain open after a successful access grant or RTE event
9. Alarm Enabled option
    a. Allows the system administrator to determine whether door held and door forced alarm events are triggered
10. RTE Inputs
    a. Shall be able to choose how to handle RTE inputs
11. Door Monitoring Input
    a. Shall be able to choose how to handle door monitoring input
12. PIN Timeout
    a. Shall be able to determine the PIN timeout
13. Attempt Limit
    a. Shall be able to determine attempt limit
14. Failed Attempt Lockout Time
    a. Shall be able to determine the failed attempt lockout time
15. Access Method
    a. Shall be able to determine the access method
16. Scheduled Lock and Unlock
    a. Support door lock and unlock functionality via schedules that can be independently assigned to doors
17. Timed Unlock

a. Support timed unlock for user-defined period of time
b. Door shall unlock when access is granted and shall remain unlocked until specified unlock time expires

18. Lock On Close
    a. Support lock on close
    b. Door shall unlock when access is granted and shall remain unlocked until either the specified unlock time expires, or the door is opened and closed, whichever occurs first
19. Full Host-Independent or Offline Operation
20. Unlock All Doors on Fire
    a. Support unlocking all doors based on inputs or based on operator action
21. Fallback Mode Operation
    a. Support a fallback mode for offline door controllers
    b. The selected mode is common to all doors and shall be configured at the controller level
    c. Available modes:
        i) No Access = No access (default)
        ii) Site Code Access = Access if credential site code matches site code defined in card formats
        iii) All Access = Access if credential format is recognized
        iv) Use Local Cache Table = (For IPSDCs only) Access if credential matches one of the last 100 credentials used to successfully gain access
22. Holidays
    a. Single Date
    b. Yearly Recurring Date
    c. Yearly Recurring Day or Week or Month
23. Reader groups
    a. Groups shall provide a logical grouping to facilitate creating access levels
24. Anti-passback (APB)
    a. Users shall be able to define areas and assign those areas as entry or exit areas to readers, as well as define the APB mode for the areas
    b. The system shall track a credential's current area (APB is tracked and enforced by credential, not by person)
    c. Hard and soft APB enforcement shall be allowed
        i) Hard requires manual reset of credential
        ii) Soft merely logs the event
    d. Shall support configurable APB auto-reset per area

Access Control Mobile Applications

A. Mobile Device Support
    1. Support for i0S devices, including iPad and iPhone
        a. Apps available via iTunes® and the Apple® App Store
    2. Support for Android phones
        a. App available via the Google Play store

Access Control Software Interfaces

A. Access Control Software Functionality
    1. Installation Wizard
        a. Separate standalone installation utility
        b. Supported by Windows 7 and 10 (32-bit or 64-bit)
        c. Shall support multiple languages
        d. Shall allow user to perform initial configuration

i) Shall allow user to install Microsoft .NET Framework 4.5 and Bonjour prerequisites
ii) Shall allow user to change the default Administrator password to enhance security
iii) Shall allow user to set the time zone, date, and time
iv) Shall allow user to set System controller IP address and DHCP or static IP
v) Shall allow user to select network options, including Static or DHCP, IP address, service port, Hypertext Transfer Protocol (HTTP) or HTTP Secure (HTTPS) protocol

e. Shall detect the System Controller on the LAN
f. Shall provide link to launch System application for the selected System Controller

2. Import/Export Wizard
   a. Separate standalone utility to import and export data in Comma Separated Values (CSV) format
   b. Supported by Windows 7 and 10 (32-bit or 64-bit) operating system
   c. Shall support multiple languages
   d. Shall allow user to import persons and credentials data in CSV format
      i) Shall load a CSV file where each record contains person data and optional data for one credential
      ii) Shall allow mapping of CSV fields to System data
      iii) Shall allow user to declare CSV file to be used for add or update or delete operation (on a per file basis, not per record)
      iv) Shall allow all settings to be saved or restored to or from a file
      v) Shall process all records in CSV file without requiring user interaction
      vi) Shall allow mapping of access level names in CSV file to existing access level names in System
      vii) Shall support importing of person photo via locally accessible files whose path is a field on the CSV file
      viii) Shall support selecting which fields uniquely identify a record
   e. Shall allow user to export persons and credentials data in CSV format
      i) Shall allow user to select person and credential data for export
      ii) Shall always export all available records
      iii) Shall allow user to select which fields and what field order (within a record) to export
      iv) Shall support export of person photos
      v) Shall output records in pre-defined sort order
      vi) Shall allow all settings to be saved or restored to or from a file
      vii) Shall output all records to CSV file without requiring user interaction
   f. Shall handle special characters
   g. Shall produce an HTML-formatted report with summary information of import or export
   h. Shall allow user to delete persons and credentials data in batch mode
   i. Shall allow user to export events that provide an historical record of system activity
3. Email Support
   a. Shall support the ability to configure an internal or external Simple Mail Transfer Protocol (SMTP) server
   b. Shall allow user to create email distribution lists
   c. Automated emails can be generated after:
      i) Scheduled backups occur
      ii) Action triggers are executed
4. Backup and Restore

a. Support full backup and restore of database to or from a file
b. Backup file shall be encrypted
c. Backups can be scheduled to occur automatically
    i) Shall support automated emails to notify users about successful or failed backups
    ii) Shall support the copying of backup files to shared network resources
d. Backup and restore shall include all records and settings that a user can configure through the User Interface with the exception of:
    i) Network configuration settings
    ii) Door or reader states set manually via the Door page
    iii) Events
e. Support separate backup of events to a file for recordkeeping purposes
f. Support the ability to restore the System Controller to its original factory settings

5. Diagnostics
    a. Informational simple diagnostics
    b. Visual indicators for common failure modes that allow end users to troubleshoot
    c. Power and hardware status
    d. Resource usage
    e. System and device capacities
    f. Supports the ability to gather system information and log files into an encrypted file that can be sent to Technical Support
6. System Functions
    a. Perform a scan for hardware changes
    b. Control access of doors based on user-defined access control schedules
    c. Create and configure schedules, holidays, and access levels
    d. Manage persons and credentials
    e. Control system functions remotely
        i) Monitor events, event video, and alarms
        ii) Inputs and outputs
        iii) Action triggers
        iv) Schedules
        v) Secure, lockout, and open doors
        vi) Reset Anti-passback (APB)
    f. Manage alarms
    g. Configure doors and readers
    h. Grant access to users according to time and place
    i. Update access rights
    j. Send automated emails
    k. Configure group permission policies
    l. Configure automated action triggers that are executed when a set of conditions are satisfied
    m. Configure shared network resources where scheduled backup files can be sent
7. Operator Interface:
    a. Use a Web-based client user interface for system configuration, administration, management, and monitoring operations
        i) Flash plug-in required for Web-based client
    b. Provide online context-sensitive help files to assist operators in system configuration and operation
8. Operator Roles
    a. Provide up to 32 operator roles

b. Each role shall have a fixed set of permissions and shall be able to be configured for different permission levels
c. Include five (5) pre-defined roles

9. Reporting
   a. System shall provide predefined reports
      i) Historical
         a) Access History
      ii) Temporal
         a) Person or Roster
         b) Credential
         c) Reader Access
         d) Roll Call
   b. Allow limited filtering based on report type
   c. Generated in HTML format and viewed in separate browser instance (or tab) from User interface
   d. Fixed output fields and layout
   e. Printable via Internet browser functionality
   f. Export to CSV file
   g. Permission controlled

Access Control Door Controllers

A. Door Controller
   a. Support
      i) Each module supports 16 inputs
      ii) Each output module supports eight (8) outputs
   b. Support downstream modules via multi-drop RS-485 communications
   c. Support removable terminal blocks for all connections to downstream modules and digital inputs, relay outputs, and readers
   d. Support on-board diagnostic LEDs on the System Controller
   e. End Of Line (EOL) Supervision resistors
      i) Configurable
      ii) Single or double
      iii) 1K or 4K7
   f. Report door forced alarms
   g. Report door held alarms
   h. Report system alarms
   i. Report tamper alarms
   j. Battery Backup:
      i) Sealed lead acid; sized to provide run time during a power outage of 90 minutes, complying with UL 924.
      ii) Backup Battery: Valve-regulated, recombinant-sealed, lead-acid battery; spill proof.
   k. Controller Power: NFPA 70, Class II power-supply transformer, with 12- or 24-V ac secondary, backup battery and charger. With single-stage, constant-voltage-current, limited battery charger, comply with battery manufacturer's written instructions for battery terminal voltage and charging current recommendations for maximum battery life.
   l. Power Monitoring: Provide manual, dynamic battery-load test, initiated and monitored at the control center; with automatic disconnection of the controller when battery voltage drops below controller limits. Report by using local controller-mounted digital displays and by communicating status to central station. Indicate

normal power on and battery charger on trickle charge. Indicate and report the following:

i) Trouble Alarm: Normal power-off load assumed by battery.
ii) Trouble Alarm: Low battery.
iii) Alarm: Power off.

Card Readers

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Schlage MTK15 or equivalent by HID Proximity Card Readers
B. Provide with a multi-colored LED and audible device, which shall change state on presentation of a valid proximity card.
C. Card-Reader Power: Powered from its associated controller, including its standby power source, and shall not dissipate more than 5 W.
D. Range: Read range of 5" to 9" standard. (Except long range gate reader which shall be 20” min.)
E. Response Time: Card reader shall respond to passage requests by generating a signal that is sent to the controller. Response time shall be 800 ms or less, from the time the card reader finishes reading the credential card until a response signal is generated.
F. Provide all necessary backboxes and mounting brackets required for installation of the reader where shown on the plans.
G. Readers shall be provided with a lifetime warranty
H. Readers shall be black.

Access Control Cards

I. Cards
   1. Support card formats with total bit lengths of 20—200 bits (total card length and includes bits for card number, facility code, issue code, and parity bits)
   2. Maximum card number limited to 128 bits
   3. Maximum credential ID value that a user can enter when creating a credential shall depend on the defined card formats in the system
   4. If no formats are defined, the maximum shall be based on 128 bit card number and shall allow numbers between one (1) and 2^{128}-1
   5. If any formats are defined, the user can enter numbers between 1 and 2^{N}-1, where N is the largest card number bit length of all defined formats
   6. Support keypad readers for card and PIN access
   7. Support expiration dates for credentials
J. Cardholders
   1. Support up to 100 persons and credentials
   2. All credentials in the system must be assigned to a person
   3. Supports RF Ideas credential card readers that can be used to read ID badge data and insert credential information into the User Interface

Lock Power Supplies

A. Input:
   1. Input 115VAC, 60Hz,
B. Output:
   1. 12VDC or 24VDC selectable outputs.
   2. 6 amp supply current.
   3. Five (5) PTC protected Class 2 Rated power limited outputs, rated @ 2 amp.
   4. Output relay energizes when unit is triggered (form "C" contact rated 1 amp @ 28VDC).
   5. Filtered and electronically regulated output.
   6. Short circuit and thermal overload protection.

C. Battery Backup:
   1. Built-in charger for sealed lead acid or gel type batteries.
   2. Automatic switch over to stand-by battery when AC fails.
   3. Maximum charge current 0.7 amp.

D. Supervision:
   1. AC fail supervision (form "C" contacts). Notification trigger is selectable for 30 seconds (factory set) or 6 hours.
   2. Low battery supervision (form "C" contacts).
   3. Battery presence supervision (form "C" contacts).
   4. Power fail supervision relay (form "C" contacts).

E. Visual Indicators:
   1. AC input and DC output LED indicators (power supply board).
   2. Red LEDs indicate condition of power outputs (multi-output board).
   3. Power & input trigger LEDs (multi-output board).

Request To Exit Sensors

A. Motion detectors Request to Exit RTE Exit sensors shall be passive infrared specifically for request-to-exit application. Exit sensor shall be UL listed, 12 or 24 volt operation and be wall or ceiling mountable. Sensor shall also have the following features:
   1. Capable of double door use
   2. Two form "C" contacts
   3. Latch time adjustable to sixty (60) seconds
   4. Selectable fail safe/fail secure
   5. Pattern pointability of +/- 14 Deg. Vertical.

Door Position Switches

A. Door positions shall be magnetic recessed door contacts shall be heavy duty, color by architect, 1” diameter.

Cables

A. General Cable Requirements: Comply with requirements in Section 28 05 13 "Conductors and Cables for Electronic Safety and Security" and as recommended by system manufacturer for integration requirement.

B. PVC-Jacketed, TIA 232-F Cables:
   1. Two pairs, No. 22 AWG, stranded (7x30) tinned copper conductors, polypropylene insulation, and individual aluminum-foil/polyester-tape shielded pairs with 100 percent shield coverage; PVC jacket.
   2. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
   3. NFPA 70, Type CM.
   4. Flame Resistance: UL 1581 vertical tray.

C. PVC-Jacketed, TIA 485-A Cables: Two pairs, twisted, No. 22 AWG, stranded (7x30) tinned copper conductors, PVC insulation, unshielded, PVC jacket, and NFPA 70, Type CMG.
   1. Multiconductor, PVC, Reader and Wiegand Keypad Cables:
   2. No. 22 AWG, paired and twisted multiple conductors, stranded (7x30) tinned copper conductors, semirigid PVC insulation, overall aluminum-foil/polyester-tape shield with 100 percent shield coverage, plus tinned copper braid shield with 65 percent shield coverage, and PVC jacket.
   3. NFPA 70, Type CMG.
   4. Flame Resistance: UL 1581 vertical tray.
   5. For TIA 232-F applications.

D. Paired, PVC, Reader and Wiegand Keypad Cables:

1. Three pairs, twisted, No. 22 AWG, stranded (7x30) tinned copper conductors, polypropylene insulation, individual aluminum-foil/polyester-tape shielded pairs each with No. 22 AWG, stranded tinned copper drain wire, 100 percent shield coverage, and PVC jacket.
2. NFPA 70, Type CM.
3. Flame Resistance: UL 1581 vertical tray.

E. Paired, PVC, Reader and Wiegand Keypad Cables:
1. Three pairs, twisted, No. 20 AWG, stranded (7x28) tinned copper conductors, polyethylene (polyolefin) insulation, individual aluminum-foil/polyester-tape shielded pairs each with No. 22 AWG, stranded (19x34) tinned copper drain wire, 100 percent shield coverage, and PVC jacket.
2. NFPA 70, Type CM.
3. Flame Resistance: UL 1581 vertical tray.

F. Paired, Lock Cables:
1. One pair, twisted, No. 16 AWG, stranded (19x29) tinned copper conductors, PVC insulation, unshielded, and PVC jacket.
2. NFPA 70, Type CMG.
3. Flame Resistance: UL 1581 vertical tray.

G. Paired, Lock Cables:
1. One pair, twisted, No. 18 AWG, stranded (19x30) tinned copper conductors, PVC insulation, unshielded, and PVC jacket.
2. NFPA 70, Type CMG.
3. Flame Resistance: UL 1581 vertical tray.

H. Paired, Input Cables:
1. One pair, twisted, No. 22 AWG, stranded (7x30) tinned copper conductors, polypropylene insulation, overall aluminum-foil/polyester-tape shield with No. 22 AWG, stranded (7x30) tinned copper drain wire, 100 percent shield coverage, and PVC jacket.
2. NFPA 70, Type CMR.
3. Flame Resistance: UL 1666 riser flame test.

I. Paired, AC Transformer Cables:
1. One pair, twisted, No. 18 AWG, stranded (7x26) tinned copper conductors, PVC insulation, unshielded, and PVC jacket.
2. NFPA 70, Type CMG.

J. LAN Cabling:
1. Comply with requirements in Section 28 05 13 "Conductors and Cables for Electronic Safety and Security."
2. NFPA 262.

Access Control Interfaces to Video Surveillance

A. Video Integration:
1. Support viewing of live and recorded video
2. Support creation of video clips
3. Support PTZ control of cameras from within the application window
4. Support integration with video surveillance systems
   a. Video recorders:
      i) Provide an integrated digital video recorder and camera management interface for video command and control
      ii) Provide a multi-window video management console for real time video device monitoring and control from any operator workstation
      iii) Display video recorders, cameras and assigned presets in a navigation pane for operator access

iv) Support request for live and recorded video transmission from video recording units at various resolutions and display sizes, independent of actual resolution settings for local recorded video, user configurable to facilitate network adaptability
v) Support multiple video recording devices

5. Requires Internet Explorer to allow install of ActiveX control
6. Video shall be associated with door and reader alarms
7. Video shall be played by the timestamp recorded with the door or reader event

PART 3 - EXECUTION

3.01 CARD READERS

A. Install readers' level and plumb.
B. Identify readers according to Section 260533 "Identification for Electrical Systems."
C. Card readers must interface with wireless system.

3.02 READER CONTROLLERS

A. Install controllers' level and plumb.
B. Identify controllers' according to Section 260533 "Identification for Electrical Systems."
C. Coordinate location of controllers at door or within telecommunications room with owner and other trades before rough-in.

3.03 REQUEST TO EXIT SENSORS

A. Install sensors level and plumb.
B. Identify sensors according to Section 260533 "Identification for Electrical Systems."
C. Coordinate location of sensors at door or at ceiling with owner and all other trades before rough-in.

3.04 DOOR POSITION SWITCHES

A. Coordinate location of switch at door with architect and all other trades before rough-in.

3.05 NETWORK WORKSTATIONS

A. Coordinate exact location with owner/architect/engineer and all other trades before rough-in.
B. Provide a minimum of one quadraplex power outlet on a dedicated circuit and one voice/data outlet at each control station. Station to be connected to UPS power within space allocated for device(s).

3.06 OPERATING SYSTEM AND APPLICATION SOFTWARE

A. Develop, install, and test software and hardware, and perform database tests for the complete and proper operation of systems involved. Assign software license to Owner.

3.07 SURGE AND TAMPER PROTECTION

A. Install surge and tamper protection per manufacturer requirements.

3.08 INTEGRATION WITH OTHER SYSTEMS

A. Each system must be coordinated with the access control system so that alarms and devices will function as owner requires. All programming to be determined by integration contractor with owner before submitting bid pricing.

3.09 CABLES

A. Comply with NECA 1, "Good Workmanship in Electrical Construction."
B. Install cables and wiring according to requirements in Section 280513 "Conductors and Cables for Electronic Safety and Security."
C. Wiring Method: Install wiring in raceway and cable tray except within consoles, cabinets, desks, and counters. Conceal raceway and wiring except in unfinished spaces.
D. Wiring Method: Install wiring in raceway and cable tray except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring

method may be used. Use NRTL-listed plenum cable in environmental airspaces, including plenum ceilings. Conceal raceway and cables except in unfinished spaces.

E. Install LAN cables using techniques, practices, and methods that are consistent with Category 5E rating of components and fiber-optic rating of components, and that ensure Category 6 and fiber-optic performance of completed and linked signal paths, end to end.

F. Boxes and enclosures containing security-system components or cabling, and which are easily accessible to employees or to the public, shall be provided with a lock. Boxes above ceiling level in occupied areas of the building shall not be considered accessible. Junction boxes and small device enclosures below ceiling level and easily accessible to employees or the public shall be covered with a suitable cover plate and secured with tamperproof screws.

G. Install end-of-line resistors at the field device location and not at the controller or panel location.

H. Comply with TIA 569-B, "Commercial Building Standard for Telecommunications Pathways and Spaces."

I. Cable application requirements are minimum requirements and shall be exceeded if recommended or required by manufacturer of system hardware.

J. TIA 232-F Cabling: Install at a maximum distance of 50 ft. (15 m).

K. TIA 485-A Cabling: Install at a maximum distance of 4000 ft. (1220 m).

L. Card Readers and Keypads:
   1. Install number of conductor pairs recommended by manufacturer for the functions specified.
   2. Unless manufacturer recommends larger conductors, install No. 22 AWG wire if maximum distance from controller to the reader is 250 ft. (75 m), and install No. 20 AWG wire if maximum distance is 500 ft. (150 m).
   3. For greater distances, install "extender" or "repeater" modules recommended by manufacturer of the controller.
   4. Install minimum No. 18 AWG shielded cable to readers and keypads that draw 50 mA or more.

M. Install minimum No. 16 AWG cable from controller to electrically powered locks. Do not exceed **250 ft.** .

N. Install minimum No. 18 AWG ac power wire from transformer to controller, with a maximum distance of **25 ft. (8 m)**.

3.10 EXAMINATION

A. Examine pathway elements intended for cables. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation.

B. Examine roughing-in for LAN and control cable conduit systems to PCs, controllers, card readers, and other cable-connected devices to verify actual locations of conduit and back boxes before device installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.11 PREPARATION

A. Comply with recommendations in SIA CP-01.

B. Comply with TIA/EIA 606-A, "Administration Standard for Commercial Telecommunications Infrastructure."

C. Obtain detailed Project planning forms from manufacturer of access-control system; develop custom forms to suit Project. Fill in all data available from Project plans and specifications and publish as Project planning documents for review and approval.
   1. Record setup data for control station and workstations.
   2. For each Location, record setup of controller features and access requirements.
   3. Propose start and stop times for time zones and holidays, and match up access levels for doors.
   4. Set up groups, facility codes, linking, and list inputs and outputs for each controller.
   5. Assign action message names and compose messages.
   6. Set up alarms. Establish interlocks between alarms, intruder detection, and video surveillance features.
   7. Prepare and install alarm graphic maps.
   8. Develop user-defined fields.
   9. Develop screen layout formats.

10. Propose setups for guard tours and key control.
11. Discuss badge layout options; design badges.
12. Complete system diagnostics and operation verification.
13. Prepare a specific plan for system testing, startup, and demonstration.
14. Develop acceptance test concept and, on approval, develop specifics of the test.
15. Develop cable and asset-management system details; input data from construction documents. Include system schematics and Visio Technical Drawings in electronic format AutoCad.

D. In meetings with Architect and Owner, present Project planning documents and review, adjust, and prepare final setup documents. Use final documents to set up system software.

3.12 GROUNDING

A. Comply with Section 26 05 26 "Grounding and Bonding for Electrical Systems."
B. Comply with IEEE 1100, "Recommended Practice for Power and Grounding Electronic Equipment."
C. Ground cable shields, drain conductors, and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
D. Bond shields and drain conductors to ground at only one point in each circuit.
E. Signal Ground:
   1. Terminal: Locate in each equipment room and wiring closet; isolate from power system and equipment grounding.
   2. Bus: Mount on wall of main equipment room with standoff insulators.
   3. Backbone Cable: Extend from signal ground bus to signal ground terminal in each equipment room and wiring closet.

3.13 IDENTIFICATION

A. In addition to requirements in this article, comply with applicable requirements in Section 260553 "Identification for Electrical Systems" and with TIA/EIA 606-A.
B. Using software specified in "Cable and Asset Management Software" Article, develop cable administration drawings for system identification, testing, and management. Use unique, alphanumeric designation for each cable, and label cable and jacks, connectors, and terminals to which it connects with the same designation. Use logical and systematic designations for facility's architectural arrangement.
C. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
   1. All wiring conductors connected to terminal strips shall be individually numbered, and each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with the name and number of the particular device as shown.
   2. Each wire connected to building-mounted devices is not required to be numbered at the device if the color of the wire is consistent with the associated wire connected and numbered within the panel or cabinet.
D. At completion, cable and asset management software shall reflect as-built conditions.

3.14 FIELD QUALITY CONTROL

A. Perform tests and inspections.
   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
B. Tests and Inspections:
   1. LAN Cable Procedures: Inspect for physical damage and test each conductor signal path for continuity and shorts. Use Class 2, bidirectional, Category 5 tester. Test for faulty connectors, splices, and terminations. Test according to TIA/EIA 568-B.1, "Commercial Building Telecommunications Cabling Standards - Part 1: General Requirements." Link performance for UTP cables must comply with minimum criteria in TIA/EIA 568-B.1.
   2. Test each circuit and component of each system. Tests shall include, but are not limited to, measurements of power-supply output under maximum load, signal loop resistance, and leakage to ground where applicable. System components with battery backup shall be operated on battery power for a period of not less than 10 percent of the calculated battery operating time. Provide special equipment and software if testing requires special or dedicated equipment.

3. Operational Test: After installation of cables and connectors, demonstrate product capability and compliance with requirements. Test each signal path for end-to-end performance from each end of all pairs installed. Remove temporary connections when tests have been satisfactorily completed.
4. See Section 014000 "Quality Requirements" for retesting and reinspection requirements and Section 017300 "Execution" for requirements for correcting the Work.

C. Devices and circuits will be considered defective if they do not pass tests and inspections.
D. Prepare test and inspection reports.

3.15 STARTUP SERVICE

A. Engage a factory-authorized service representative to supervise and assist with startup service.
1. Complete installation and startup checks according to approved procedures that were developed in "Preparation" Article and with manufacturer's written instructions.
2. Enroll and prepare badges and access cards for Owner's operators, management, and security personnel.

3.16 PROTECTION

A. Maintain strict security during the installation of equipment and software. Rooms housing the control station, and workstations that have been powered up shall be locked and secured with an activated burglar alarm and access-control system reporting to a central station complying with UL 1610, "Central-Station Burglar-Alarm Units," during periods when a qualified operator in the employ of Contractor is not present.

3.17 DEMONSTRATION

A. **Engage a factory-authorized service representative to train** Owner's maintenance personnel to adjust, operate, and maintain security access system. See Section 017900 "Demonstration and Training."
B. Develop separate training modules for the following:
1. Computer system administration personnel to manage and repair the LAN and databases and to update and maintain software.
2. Operators who prepare and input credentials to man the control station and workstations and to enroll personnel.
3. Security personnel.
4. Hardware maintenance personnel.
5. Corporate management.

END OF SECTION

SECTION 28 23 00
VIDEO SURVEILLANCE

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Base Bid
   1. Contractor Provide:
      a. Complete, functioning IP Video Surveillance System for distribution and recording of multiple video images.
      b. Transmit recorded images from various cameras to a network recording device and other monitoring locations as required by project.
      c. Ceiling mounted, wall mounted and outside rated cameras as indicated on project documents.
      d. All cabling, mounting devices, supports, arms, coverings, controls recording devices, encoding and decoding devices, PoE switch (layer 2/3), software, licenses and other equipment as recommended by manufacturer and as required for complete functioning system.
      e. Power over Ethernet switches shall be required to be provided by contractor.
      f. Coordinate with owner, electrical contractor, access control system and other systems as required for connection to existing network equipment, emergency notification source or to access control system. This contractor to provide all patch cords necessary to make final connections and patches to all other systems as required by owner for complete functioning and integration with other systems.
      g. Coordinate with Electrical Contractor to provide power were required.

B. Unit price Bid
   1. Contractor provide alternate unit bid price to:
      a. Add or delete one standard ceiling camera, mount and cable.

1.02 SECTION INCLUDES

A. Cameras
   1. Low Light (IR) Cameras
   2. Color Cameras
   3. Dome Cameras
   4. High Definition/Megapixel Cameras 1080p
   5. Multiple Image Sensor Cameras

B. Lenses
   1. Auto-Iris Lenses
   2. Fixed Lenses
   3. Zoom Lenses

C. Power Supplies

D. Infrared Illuminators

E. Camera Mounting Equipment
   1. Brackets
   2. Housings

F. Cabling

G. Recording System
   1. Network Video Recorder (NVR)
   2. Video Management System (VMS)

H. PoE (Layer 2/3) Switches

1.03 RELATED WORK

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Section 27 05 00 - Common Work Results for Communications Systems

C. All references including Divisions 26 apply.

1.04 SUBMITTALS

A. Submit Shop drawings for equipment under this section per Section 01 30 00 - Administrative Requirements.
   1. Cameras
   2. Lenses
   3. Power Supplies
   4. Infrared Illuminators
   5. Cabling (if not specified elsewhere)
   6. Recording System
      a. Network Video Recorder (NVR)
      b. Video Management System (VMS)
      c. Storage device and storage capacity
   7. PoE Switch (Layer 2/3)
   8. Mounting device

B. Product Data: For each type of product indicated. Include dimensions and data on features, performance, electrical characteristics, ratings, and finishes.

C. Include plans, elevations, sections, details, and attachments to other work.
   1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   2. Functional Block Diagram: Show single-line interconnections between components for signal transmission and control. Show cable types and sizes.
   3. Wiring Diagrams: For power, signal, and control wiring.

D. Equipment List: Include every piece of equipment by model number, manufacturer, and location.
   1. Field quality-control reports and/or checklists.
   2. Operation and Maintenance Data: For cameras, power supplies, infrared illuminators, monitors to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 – Operation and Maintenance Data, include the following:
      a. Lists of spare parts and replacement components recommended to be stored at the site for ready access.

1.05 FUNCTIONAL TESTS

A. All components and systems shall be tested for complete function.

B. Provide a Systems Checklist as described in Section 27 05 00, Part 3.
   1. Seismic Performance: Video surveillance system shall withstand the effects of earthquake motions determined according to ASCE/SEI 7
      a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
   2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   3. Comply with NECA 1.
   4. Comply with NFPA 70.
   5. FCC Rules and Regulations Part 1Radio Frequency Devices
   6. National Electrical Manufacturers Association (NEMA) Section 250 Enclosures for Electrical Equipment.
   7. Applicable Federal, State and Local laws, regulations and codes.
   8. Comply with UL

1.06 GUARANTEE

A. System and components shall be guaranteed free from defects in workmanship and materials for a period of 1 year from data of acceptance by Owner. During guarantee period, manufacturer shall perform services necessary on System and supplier shall provide annual inspections, written reports

to Owner detailing findings of each inspection and documentation of actions taken to remedy abnormal conditions.

B. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of cameras, equipment related to camera operation, and control-station equipment that fail in materials or workmanship within specified warranty period.

1.07 DEFINITIONS

A. AGC – Automatic Gain Control
B. FCC – Federal Communications Commission
C. IP – Internet Protocol
D. IRE – Units of Measurement
E. System – Video Surveillance System including all required components
F. PoE – Power over Ethernet
G. V – Volt
H. W – Watt
I. LUX – Minimum Illumination

1.08 FCC COMPLIANCE

A. Equipment furnished under this contract shall have been tested and made to comply with limits for Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against interference when operated in commercial environment. Literature shall so note and equipment shall be so labeled to show this compliance.

1.09 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Contractor shall furnish to Engineer, upon completion of work, but before final acceptance of system, 3 bound typewritten copies of instructions covering complete maintenance and operation of system and complete set of as-built drawings. Contractor shall instruct Owner on care, operation and maintenance of all parts of system.
B. In addition to complying with Division 26 - General Electrical Requirements, Contractor shall provide 3 sets of complete instruction manuals, service manuals, schematics, parts lists, recommended spare parts lists, and current list of local manufacturer's approved service centers.

1.10 OWNER TRAINING

A. System supplier shall provide training 2 hours minimum for Owner's personnel on operation and maintenance of System. Training shall be complete to enable personnel to perform associated tasks and functions in competent and skillful manner. Training shall be conducted during normal business hours after system start-up and Owner's acceptance.

PART 2 - PRODUCTS

2.01 CAMERAS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following. Provide product indicated on Drawings or comparable product by one of the following. Turing AI is the product of choice in order to integrate with existing city systems.
   1. Turing AI
B. Minimum
   1. ONVIF compliant
   2. Supplemental IR capability
   3. WDR
   4. 4 Mp / 16:9
   5. Audio/mic
   6. Encoding: Ultra 265, H.265, H.264, MJPEG
   7. Color
C. Cameras – interior/exterior, fixed, 101 deg angle field of view

1. Meet or exceed all specifications for:
2. Turing AI model TP-MFD4A4

D. Cameras – interior 360 deg
1. Meet or exceed specifications for:
2. Turing AI model TP-MFECM18

E. Cameras – interior/exterior 180 deg
1. Meet or exceed specifications for:
2. Turing AI model TP-MEP5M16

2.02 LENSES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following. Provide product indicated on Drawings or comparable product by one of the following:
1. Turing AI

2.03 POWER SUPPLIES

A. Low-voltage power supplies matched for voltage and current requirements of cameras and accessories, and of type as recommended by manufacturer of camera and lens.
1. Enclosure: Ratings IP (Ingress Protection).

B. 120VAC power supplies matched for voltage and current requirements of cameras and accessories, and of type as recommended by manufacture of camera and lens.

C. Contractor to provide PoE (Power over Ethernet) injector as needed per camera distances from camera location back to network switch.

2.04 CAMERA MOUNTING EQUIPMENT

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following. Provide product indicated on Drawings or comparable product by one of the following:
1. Turing AI
2. Panasonic Corporation of North America; Panasonic Security Systems

B. Minimum Load Rating: Rated for load in excess of the total weight supported times a minimum safety factor of two.

C. Mounting Brackets for Fixed Cameras: Type matched to items supported and mounting conditions. Include manual pan-and-tilt adjustment.

D. Protective Housings for Fixed and Movable Cameras: Steel enclosures with internal camera mounting and connecting provisions that are matched to camera/lens combination and mounting and installing arrangement of camera to be housed.
1. Tamper switch on access cover sounds an alarm signal when unit is opened or partially disassembled. Central-control unit shall identify tamper alarms and indicate location in alarm display.
2. Camera Viewing Window: Lexan window, aligned with camera lens.
3. Duplex Receptacle: Internally mounted.
4. Alignment Provisions: Camera mounting shall provide for field aiming of camera and permit removal and reinstallation of camera lens without disturbing camera alignment.
5. Built-in, thermostat-activated heater units. Units shall be automatically controlled so the environmental limits of the camera equipment are not exceeded.
6. Sun shield shall not interfere with normal airflow around the housing.
7. Mounting bracket and hardware for wall or ceiling mounting of the housing. Bracket shall be of same material as the housing; mounting hardware shall be stainless steel.
8. Finish: Housing and mounting bracket shall be factory finished using manufacturer's standard finishing process suitable for the environment.
9. Enclosure Rating: IPX3 min.

2.05 SURGE AND TAMPER PROTECTION

A. Surge Protection: Protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads. Include surge

protection for external wiring of each conductor-entry connection to components. This is for each camera and the entire system.

1. Minimum Protection for Power Connections 120 V and More: Auxiliary panel suppressors complying with requirements in Section 26 43 13 - Surge Protection for Low-Voltage Electrical Power Circuits.
2. Minimum Protection for Communication, Signal, Control, and Low-Voltage Power Connections: Comply with requirements in Section 26 - Surge Protection for Low-Voltage Electrical Power Circuits as recommended by manufacturer for type of line being protected.

B. Tamper Protection: Tamper switches on enclosures, control units, pull boxes, junction boxes, cabinets, and other system components shall initiate a tamper-alarm signal when unit is opened or partially disassembled. Control-station control-unit alarm display shall identify tamper alarms and indicate locations.

2.06 CABLING

A. Unshielded Twisted Pair cable elements have 100-ohm nominal impedance.
B. Video Surveillance UTP Connectors: RJ45 type

2.07 RECORDING SYSTEM

A. Network Video Recording devices are typically used for IP video and are usually referred to by the manufacturer as a dedicated recording device. These devices are connected to the network. Provide 30 days of recording for all cameras.
B. Turing AI compatible
C. 32 channels
D. 32 TB storage
E. Up to 30 fps
F. Provide one 24-32” monitor at main desk for viewing, connected with Cat6/HDMI extender from system head-end.

2.08 POE SWITCHES (LAYER 2/3)

A. Active electronic components are furnished by the contractor. The switches should be programmable, be able to support multiple protocols and capable of dealing with different types of broadcast signals (Multicast, Unicast). Switches need to consider network security, port filtering, encryption and authentication as well.

PART 3 - EXECUTION

3.01 CAMERAS

A. Install cameras level and plumb.
B. Identify cameras according to Section 26 05 53 - Identification for Electrical Systems.

3.02 LENSES

A. Set F-stops to suit final camera position and to obtain the field of view required for camera from Owner.
B. Verify operation of auto-iris lenses.
C. Set back-focus of fixed focal lenses. At focus set to infinity, simulate nighttime lighting conditions by using dark glass filter of a density that produces a clear image. Adjust until image is in focus with and without filter.
D. Set back-focus of zoom lenses. At focus set to infinity, simulate nighttime lighting conditions by using dark glass filter of a density that produces a clear image. Additionally, set zoom to full wide angle and aim camera at an object 50 to 75 feet away. Adjust until image is in focus from full wide angle to full telephoto, with the filter in place.
E. Set and name all preset positions, consult with Owner’s personnel.
F. Set sensitivity of motion detection.

3.03 POWER SUPPLIES

A. Install power supplies and other auxiliary components at control stations unless otherwise indicated.
B. Identify power supplies according to Section 26 05 53 - Identification for Electrical Systems.
C. Avoid ground loops.

3.04 CAMERA MOUNTING EQUIPMENT

A. Set pan unit and pan-tilt-zoom stops to fit camera position and to obtain the field of view required for camera. Connect all controls and alarms and adjust.
B. Install cameras with 84-inch (or as directed by Architect/Drawings) minimum clear space below cameras and their mountings. Change type of mounting to achieve required clearance.

3.05 EXAMINATION

A. Examine pathway elements intended for cables. Check raceways and other elements for compliance with space allocations, installation tolerance, hazards to camera installation, and other conditions affecting installation.
B. Examine roughing-in for LAN, WAN and IP network before device installation.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.06 WIRING

A. Comply with requirements in Section 26 05 33 - Raceways and Boxes for Electrical Systems.
B. Wiring Method: Install cables in raceways unless otherwise indicated.
C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.
D. Splices, Taps, and Terminations: For power and control wiring, use numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
E. For LAN connection and fiber-optic and copper communication wiring, comply with Section 27 13 00 - Communications Backbone Cabling and Section 27 15 00 - Communications Horizontal Cabling.
F. Grounding: Provide independent-signal circuit grounding recommended in writing by manufacturer.

3.07 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
C. Perform tests and inspections.
   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
D. Tests and Inspections:
   1. Inspection: Verify that units and controls are properly installed, connected, and labeled, and that interconnecting wires and terminals are identified.
   2. Pretesting: Align and adjust system and pretest components, wiring, and functions to verify that they comply with specified requirements. Conduct tests at varying lighting levels, including day and night scenes as applicable. Prepare video-surveillance equipment for acceptance and operational testing as indicated for each piece of equipment being furnished for project.
   3. Test Schedule: Schedule tests after pretesting has been successfully completed and system has been in normal functional operation for at least 14 days. Provide a minimum of 10 days' notice of test schedule.
   4. Operational Tests: Perform operational system tests to verify that system complies with Specifications. Include all modes of system operation. Test equipment for proper operation in all functional modes.
E. Video surveillance system will be considered defective if it does not pass tests and inspections.
F. Prepare test and inspection reports.

3.08 ADJUSTING

A. Occupancy Adjustments: When requested within 3 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to 2 visits to Project during other-than-normal occupancy hours for this purpose. Tasks shall include, but are not limited to, the following:
   1. Check cable connections.
   2. Check proper operation of cameras and lenses. Verify operation of auto-iris lenses and adjust back-focus as needed.
   3. Adjust all preset positions; consult Owner's personnel.
   4. Recommend changes to cameras, lenses and associated equipment to improve Owner's use of video surveillance system.
   5. Provide a written report of adjustments and recommendations.

3.09 CLEANING

A. Clean installed items using methods and materials recommended in writing by manufacturer.
B. Clean video-surveillance-system components, including camera-housing windows, lenses, and monitor screens.

3.10 DEMONSTRATION AND TRAINING

A. Contractor to demonstrate to Engineer and/or Owner the complete operation of all system components.
B. Contractor to provide factory trained personnel to train Owner’s maintenance personnel to adjust, operate, and maintain video-surveillance equipment.
C. Provide minimum 8 hours of training to Owner’s staff.
D. Provide minimum of 4 additional hours of follow-up training or phone call trouble-shooting as requested by owner during first six months of operation.

END OF SECTION

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SECTION 28 31 00
FIRE DETECTION AND ALARM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Fire-alarm control unit.
   2. Manual fire-alarm boxes.
   3. System smoke detectors.
   4. Heat detectors.
   5. Notification appliances.
   6. Magnetic door holders.
   7. Remote annunciator.
   8. Addressable interface device.
   9. Digital alarm communicator transmitter.
   10. Network communications.

B. Related Requirements:
   1. Section 280513 "Conductors and Cables for Electronic Safety and Security" for cables and conductors for fire-alarm systems.

1.03 DEFINITIONS

A. EMT: Electrical Metallic Tubing.
B. FACP: Fire Alarm Control Panel.
C. HLI: High Level Interface.
D. NICET: National Institute for Certification in Engineering Technologies.
E. PC: Personal computer.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product, including furnished options and accessories.
   1. Include construction details, material descriptions, dimensions, profiles, and finishes.
   2. Include rated capacities, operating characteristics, and electrical characteristics.

B. Shop Drawings: For fire-alarm system.
   1. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
   2. Include plans, elevations, sections, details, and attachments to other work.
   3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
   4. Detail assembly and support requirements.
   5. Include voltage drop calculations for notification-appliance circuits.
   6. Include battery-size calculations.
   7. Include input/output matrix.
   8. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements in this Specification and in NFPA 72.
   9. Include performance parameters and installation details for each detector.
   10. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
   11. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale; coordinate location of duct smoke detectors and access to them.

a. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators.
b. Show field wiring required for HVAC unit shutdown on alarm.
c. Locate detectors according to manufacturer's written recommendations.

12. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.

C. General Submittal Requirements:
1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:
a. Trained and certified by manufacturer in fire-alarm system design.
b. NICET-certified, fire-alarm technician.
c. Licensed or certified by authorities having jurisdiction.

D. Delegated-Design Submittal: For notification appliances and smoke and heat detectors, in addition to submittals listed above, indicate compliance with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
1. Drawings showing the location of each notification appliance and smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the device.
2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72. Calculate spacing and intensities for strobe signals and sound-pressure levels for audible appliances.
3. Indicate audible appliances required to produce square wave signal per NFPA 72.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.
B. Field quality-control reports.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.
1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following and deliver copies to authorities having jurisdiction:
a. Comply with the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
b. Provide "Fire Alarm and Emergency Communications System Record of Completion Documents" according to the "Completion Documents" Article in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
c. Complete wiring diagrams showing connections between all devices and equipment. Each conductor shall be numbered at every junction point with indication of origination and termination points.
d. Riser diagram.
e. Device addresses.
f. Record copy of site-specific software.
g. Provide "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:
1) Equipment tested.
2) Frequency of testing of installed components.
3) Frequency of inspection of installed components.
4) Requirements and recommendations related to results of maintenance.
5) Manufacturer's user training manuals.
h. Manufacturer's required maintenance related to system warranty requirements.
i. Abbreviated operating instructions for mounting at fire-alarm control unit and each annunciator unit.

B. Software and Firmware Operational Documentation:
   1. Software operating and upgrade manuals.
   2. Program Software Backup: On magnetic media or compact disk, complete with data files.
   3. Device address list.
   4. Printout of software application.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Lamps for Remote Indicating Lamp Units: Quantity equal to 5percent of amount installed, but no fewer than one unit.
   2. Lamps for Strobe Units: Quantity equal to 5 percent of amount installed, but no fewer than one unit.
   3. Smoke Detectors, Fire Detectors: Quantity equal to 10 percent of amount of each type installed, but no fewer than one unit of each type.
   4. Detector Bases: Quantity equal to two percent of amount of each type installed, but no fewer than two units of each type.
   5. Keys and Tools: One extra set for access to locked or tamper proofed components.
   6. Audible and Visual Notification Appliances: Two of each type installed.
   7. Fuses: Two of each type installed in the system. Provide in a box or cabinet with compartments marked with fuse types and sizes.

1.08 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

1.09 PROJECT CONDITIONS

A. Perform a full test of the existing system prior to starting work. Document any equipment or components not functioning as designed.
B. Use of Devices during Construction: Protect devices during construction unless devices are placed in service to protect the facility during construction.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION

A. Non-coded, addressable system, with multiplexed signal transmission and horn/strobe evacuation.
B. All components provided shall be listed for use with the selected system.
C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.02 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:
   1. Heat detectors.
   2. Smoke detectors.
   3. Automatic sprinkler system water flow.
B. Fire-alarm signal shall initiate the following actions:
   1. Continuously operate alarm notification appliances
   2. Identify alarm and specific initiating device at fire-alarm control unit and remote annunciators.
   3. Transmit an alarm signal to the remote alarm receiving station.
   4. Release fire and smoke doors held open by magnetic door holders.
   5. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
   6. Close smoke dampers in air ducts of designated air-conditioning duct systems.
   7. Record events in the system memory.
C. Supervisory signal initiation shall be by one or more of the following devices and actions:
   1. Valve supervisory switch.

2. High- or low-air-pressure switch of a dry-pipe sprinkler system.
3. User disabling of zones or individual devices.
4. Loss of communication with any panel on the network.

D. System trouble signal initiation shall be by one or more of the following devices and actions:
1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of communication with any addressable sensor, input module, relay, control module, remote annunciator, printer interface, or Ethernet module.
4. Loss of primary power at fire-alarm control unit.
5. Ground or a single break in internal circuits of fire-alarm control unit.
6. Abnormal ac voltage at fire-alarm control unit.
7. Break in standby battery circuitry.
8. Failure of battery charging.
9. Abnormal position of any switch at fire-alarm control unit or annunciator.

E. System Supervisory Signal Actions:
1. Initiate notification appliances.
2. Identify specific device initiating the event at fire-alarm control unit and remote annunciators.
3. After a time delay of 200 seconds, transmit a trouble or supervisory signal to the remote alarm receiving station.

2.03 FIRE-ALARM CONTROL UNIT

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following
1. Notifier, by Honeywell
2. Edwards, by United Technologies
3. Siemens

B. General Requirements for Fire-Alarm Control Unit:
1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864.
   a. System software and programs shall be held in nonvolatile flash, electrically erasable, programmable, read-only memory, retaining the information through failure of primary and secondary power supplies.
   b. Include a real-time clock for time annotation of events on the event recorder and printer.
   c. Provide communication between the FACP and remote circuit interface panels, annunciators, and displays.
   d. The FACP shall be listed for connection to a central-station signaling system service.
   e. Provide nonvolatile memory for system database, logic, and operating system and event history. The system shall require no manual input to initialize in the event of a complete power down condition. The FACP shall provide a minimum 500-event history log.
2. Addressable Initiation Device Circuits: The FACP shall indicate which communication zones have been silenced and shall provide selective silencing of alarm notification appliance by building communication zone.
3. Addressable Control Circuits for Operation of Notification Appliances and Mechanical Equipment:

C. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
1. Annunciator and Display: Liquid-crystal type, 80 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.

D. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits:
1. Pathway Class Designations: NFPA 72, Class B
2. Pathway Survivability: Level 0.
3. Install no more than 50addressable devices on each signaling-line circuit.

4. Serial Interfaces:
   a. One dedicated RS 485 port for central-station operation using point ID DACT.
   b. One RS 485 port for remote annunciators, Ethernet module, or multi-interface module (printer port).
   c. One USB port for PC configuration.

E. Smoke-Alarm Verification:
1. Initiate audible and visible indication of an "alarm-verification" signal at fire-alarm control unit.
2. Activate an approved "alarm-verification" sequence at fire-alarm control unit and detector.
3. Sound general alarm if the alarm is verified.
4. Cancel fire-alarm control unit indication and system reset if the alarm is not verified.

F. Notification-Appliance Circuit:
1. Audible appliances shall sound in a three-pulse temporal pattern, as defined in NFPA 72.
2. Visual alarm appliances shall flash in synchronization where multiple appliances are in the same field of view, as defined in NFPA 72.

2.04 SYSTEM SMOKE DETECTORS

A. General Requirements for System Smoke Detectors:
1. Comply with UL 268; operating at 24-V dc, nominal.
2. Detectors shall be **two**-wire type.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.

B. Photoelectric Smoke Detectors:
1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
   a. Primary status.
   b. Device type.
   c. Present average value.
   d. Present sensitivity selected.
   e. Sensor range (normal, dirty, etc.).
3. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
   a. Primary status.
   b. Device type.
   c. Present average value.
   d. Present sensitivity selected.
   e. Sensor range (normal, dirty, etc.).

2.05 HEAT DETECTORS

A. General Requirements for Heat Detectors: Comply with UL 521.
1. Temperature sensors shall test for and communicate the sensitivity range of the device.

B. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 190 deg F (88 deg C)
1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.06 NOTIFICATION APPLIANCES

A. General Requirements for Notification Appliances: Individually addressed, connected to a signaling-line circuit, equipped for mounting as indicated, and with screw terminals for system connections.

B. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet (3 m) from the horn, using the coded signal prescribed in UL 464 test protocol.
   1. Wall mounted – Low profile white – Wheelock HN series or similar
   2. Ceiling mounted – Low profile white – Wheelock HNC series or similar

C. Visible Notification Appliances: Xenon strobe lights complying with UL 1971, with clear or nominal white polycarbonate lens mounted on faceplate. The word "FIRE" is engraved in minimum 1-inch-(25-mm-) high letters on the lens.
   1. Rated Light Output:
      a. 15/30/75/110/135 cd, selectable in the field.
   2. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
   3. Flashing shall be in a temporal pattern, synchronized with other units.
   4. Strobe Leads: Factory connected to screw terminals.
   5. Wall mounted – Low profile white – Wheelock ST series or similar
   6. Ceiling mounted – Low profile white – Wheelock STC series or similar

D. Combination Horn & Strobe Appliances
   1. Device shall comply with the requirements of horns and visual appliances listed above.
   2. Wall mounted – Low profile white – Wheelock HS series or similar
   3. Ceiling mounted – Low profile white – Wheelock HSC series or similar

2.07 ADDRESSABLE INTERFACE DEVICE

A. General:
   1. Include address-setting means on the module.
   2. Store an internal identifying code for control panel use to identify the module type.
   3. Listed for controlling HVAC fan motor controllers.

B. Monitor Module: Microelectronic module providing a system address for alarm-initiating devices for wired applications with normally open contacts.

C. Integral Relay: Capable of providing a direct signal to elevator controller to initiate elevator recall, to circuit-breaker shunt trip for power shutdown.
   1. Allow the control panel to switch the relay contacts on command.
   2. Have a minimum of two normally open and two normally closed contacts available for field wiring.

D. Control Module:
   1. Operate notification devices.

2.08 REMOTE ANNUNCIATOR

A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.

B. Mounting: Flush cabinet, NEMA 250, Type 1.

C. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.09 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632.

B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture two telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal

and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.

C. If accepted by local AHJ, an IP or IP/GSM Communicator option shall be provided to interface to the DACT and be capable of transmitting signals over the internet/intranet network to a compatible receiver.

D. Local functions and display at the digital alarm communicator transmitter shall include the following:
   1. Verification that both telephone lines are available.
   2. Programming device.
   3. LED display.
   4. Manual test report function and manual transmission clear indication.
   5. Communications failure with the central station or fire-alarm control unit.

E. Digital data transmission shall include the following:
   1. Address of the alarm-initiating device.
   2. Address of the supervisory signal.
   3. Address of the trouble-initiating device.
   4. Loss of ac supply.
   5. Loss of power.
   6. Low battery.
   7. Abnormal test signal.
   8. Communication bus failure.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.
   1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.

B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 EQUIPMENT INSTALLATION

A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."
   1. Devices placed in service before all other trades have completed cleanup shall be replaced.
   2. Devices installed but not yet placed in service shall be protected from construction dust, debris, dirt, moisture, and damage according to manufacturer's written storage instructions.

B. Install wall-mounted equipment, with tops of cabinets not more than 78 inches (1980 mm) above the finished floor.

C. Smoke- or Heat-Detector Spacing:
   1. Comply with the "Smoke-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.
   2. Comply with the "Heat-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for heat-detector spacing.
   3. Smooth ceiling spacing shall not exceed 30 feet (9 m).
   4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Annex A or Annex B in NFPA 72.
   5. HVAC: Locate detectors not closer than 60 inches (1520 mm) from air-supply diffuser or return-air opening.
   6. Lighting Fixtures: Locate detectors not closer than 12 inches (300 mm) from any part of a lighting fixture and not directly above pendant mounted or indirect lighting.

D. Install a cover on each smoke detector that is not placed in service during construction. Cover shall remain in place except during system testing. Remove cover prior to system turnover.
E. Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location. Do not install smoke detectors in sprinklered elevator shafts.
F. Remote Status and Alarm Indicators: Install in a visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.
G. Audible Alarm-Indicating Devices: Install not less than 6 inches (150 mm) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Install all devices at the same height unless otherwise indicated.

3.03 PATHWAYS

A. Pathways (cabling) shall be installed in EMT or exposed Free Air above accessible ceilings.
B. Pathways (cabling) shall be installed in EMT in all locations other than above accessible ceilings.
C. Refer to 26 05 23 for Free Air cabling installation requirements.

3.04 CONNECTIONS

A. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 36 inches (910 mm) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
   1. Smoke dampers in air ducts of designated HVAC duct systems.
   2. Electronically locked doors and access gates.
   3. Alarm-initiating connection to elevator recall system and components.
   4. Alarm-initiating connection to activate emergency lighting control.
   5. Supervisory connections at valve supervisory switches.

3.05 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
B. Install framed instructions in a location visible from fire-alarm control unit.

3.06 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.
B. Ground shielded cables at the control panel location only. Insulate shield at device location.

3.07 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by authorities having jurisdiction.
B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
C. Perform tests and inspections.
D. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
   1. Visual Inspection: Conduct visual inspection prior to testing.
      a. Inspection shall be based on completed record Drawings and system documentation that is required by the "Completion Documents, Preparation" table in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
      b. Comply with the "Visual Inspection Frequencies" table in the "Inspection" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
   2. System Testing: Comply with the "Test Methods" table in the "Testing" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
   3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.

4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" section of the "Fundamentals" chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

E. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
F. Fire-alarm system will be considered defective if it does not pass tests and inspections.
G. Prepare test and inspection reports.
H. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.
I. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.08 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include **12** months' full maintenance by skilled employees of manufacturer's designated service organization. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
   1. Include visual inspections according to the "Visual Inspection Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
   2. Perform tests in the "Test Methods" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
   3. Perform tests per the "Testing Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

3.09 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.
B. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for **two** years.
C. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within **two** years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.
   1. Upgrade Notice: At least **30** days to allow Owner to schedule access to system and to upgrade computer equipment if necessary.

3.10 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION

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SECTION 21 05 00

COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Base Bid: It is the intent of these specifications to provide complete and workable fire suppression systems as shown on the accompanying plans and as specified herein except such parts as are specifically exempted herein. Provide all necessary supervision, coordination, labor, materials, equipment, fixtures, drayage, hoisting, tools, transportation, plant services and facilities, machinery and connections to utilities for the installation of complete and operable fire protection systems. If details or special conditions are required in addition to those shown on drawings, provide all material and equipment usually furnished with such systems or required to complete their installation, whether noted in plans and specification or not.

B. Materials and labor shall be new (unless noted otherwise), first class and workmanlike and shall be subject at all times to the A/E's inspections, tests and approval from the commencement until the acceptance of the completed work.

C. The layout shown on the drawings is diagrammatic but shall be followed as closely as other work will permit. The drawings provide design intent. The Contractor shall verify all dimensions at the site and be responsible for their accuracy.

D. Because of the scale of the drawings, certain basic items, such as, pipe fittings, access panels, and sleeves, may not be shown. Where such items are required by Code or by other Sections, or where required for proper installation of the Work, such items shall be included, whether shown or not.

E. In the event of any inconsistencies between the specifications, drawings, contract documents, applicable laws, statutes, ordinances, building codes, rules and regulations, the contractor shall provide the better quality or greater quantity of work and comply with or conform its work to the most stringent legal or contractual requirements.

F. Changes from these drawings required to make this work conform to the building construction shall be made only with prior written approval of the Architect/Engineer. All proposed changes shall be shown on shop drawings. All measurements shall be verified by actual observation and all work shall fit in place meeting the approval of the Architect/Engineer.

G. Equipment specification may not deal individually with minute items required, such as components, parts, controls, and devices which may be required to produce the equipment performance specified or as required to meet the equipment warranties. Where such items are required to make the system operational, they shall be included by the supplier of the equipment at no additional cost, whether or not specifically called for.

1.02 SECTION INCLUDES

A. This section includes information common to two or more technical fire suppression specification section or items that are of a general nature, not conveniently fitting into other technical sections.

1. Submittals
2. Reference Standards
3. Quality Assurance
4. Design Criteria
5. Guarantee
6. Operation and Maintenance Instructions
7. Record Documents
8. Continuity of Existing Services
9. Protection of Finished Surfaces
10. Sealing and Firestopping

11. Off Site Storage
12. Regulatory Requirements
13. Certificates and Inspections
14. Coordination
15. Demolition and Existing Requirements
16. Request and Certification for Payment
17. Sleeves and Openings
18. Omissions
19. Definitions
20. Project/Site Conditions
21. Work Sequence and Scheduling
22. Salvage Materials
23. Training
24. Access Panels and Doors
25. Identification
26. Demolition
27. Concrete Work
28. Cutting and Patching
29. Lintels
30. Building Access
31. Equipment Access
32. Lubrication
33. Housekeeping and Clean Up

1.03 RELATED WORK

A. Applicable provisions of Division 1 govern work under this section.

B. This section applies to all Division 21 sections of fire suppression.

1.04 SUBMITTALS

A. Submit shop drawings for equipment under each section per requirements listed in that section, as well as per Division 1.

B. Submit for all equipment and systems as indicated in the respective specification sections, marking each submittal with that specification section number. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in the contract documents. Failure to do this may result in the submittal(s) being returned to the Contractor for correction and resubmission. Do not submit hard copies of web pages. Failing to follow these instructions does not relieve the Contractor from the requirement of meeting the project schedule.

C. On request from the A/E, the successful bidder shall furnish additional drawings, illustrations, catalog data, performance characteristics, etc.

D. Submittals shall be grouped to include complete submittals of related systems, products, and accessories in a single submittal. Mark dimensions and values in units to match those specified. Include wiring diagrams of electrically powered equipment.

E. The submittals must be approved before fabrication is authorized.

F. Provide electronic copies of all submittals for review. Electronic submittals shall be sent to wi@henneman.com for review.

G. Before submitting electrically powered equipment, verify that the electrical power and control requirements for the equipment are in agreement with the motor starter schedule on the electrical drawings. Include a statement on the shop drawing transmittal to the architect/engineer that the equipment submitted, and the motor starter schedule is in agreement or indicate any discrepancies.

H. Not more than two weeks after award of contract but before any product submittals or shop drawings are submitted, contractor to submit the following fire protection system data sheet. List piping material types, ASTM number, schedule or pressure class, joint type, manufacturer and model number where appropriate. List valves, specialties and equipment with manufacturer and model number. The approved fire suppression system data sheet(s) will be made available to the Owner's Project Representative for their use on this project.

I. Fire Suppression System Data Sheet:

Item	Pipe Service/Sizes	Manufacturer/Model No.	Remarks
Pipe			
Fittings			
Hangers & Supports			
Sprinklers			
Valves			
Specialties			
Equipment			

1. Product submittals are to be bound, labeled, contain the project manual cover page and a material index list page showing item designation, manufacturer and additional items supplied with the installation. Submit for all equipment and systems as indicated in the respective specification sections, marking each submittal with that specification section number. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in the contract documents. Include wiring diagrams of electrically powered equipment.
2. Submit one (1) sample of each proposed sprinkler type to Architect/Engineer for approval.
3. Submit working plans indicating water supply location and size, piping layout and size, sprinkler locations and type, hanger locations and type, equipment locations and type, valve locations and type occupancy classes hydraulic reference points, design areas and discharge densities per NFPA 13.
4. Submit hydraulic calculations for water supply and sprinkler systems. Include summary sheet, detailed work sheets and a graphic representation of the complete hydraulic calculation plotted on semi-exponential graph paper per NFPA 13.
5. Submit working plans and hydraulic calculations for automatic sprinkler systems to the Architect/Engineer for approval prior to submittal to the local Fire Department.
6. Submit plan approval application, working plans and hydraulic calculation for automatic sprinkler systems to the owner's insurance underwriter or local AHJ for approval. Submit copy of approval letter from local Fire Department to Architect/Engineer.
7. Submit sufficient quantities of data sheets and shop drawings to allow the following distribution:
   a. Operating and Maintenance Manuals 2 copies
   b. Architect/Engineer 1 copy
   c. Local Fire Chief or Marshal 1 copy

1.05 REFERENCE STANDARDS

A. Abbreviations of standards organizations referenced in this and other sections are as follows:

1. ANSI American National Standards Institute
2. ASME American Society of Mechanical Engineers

3. ASTM American Society for Testing and Materials
4. AWWA American Water Works Association
5. AWS American Welding Society
6. EPA Environmental Protection Agency
7. FM FM Global (Factory Mutual Insurance Company)
8. FS Federal Specifications, U.S. Government Printing Office
9. IEEE Institute of Electrical and Electronics Engineers
10. ISA Instrument Society of America
11. MSS Manufacturer's Standardization Society of the Valve & Fitting Industry, Inc.
12. NBS National Bureau of Standards
13. NEC National Electric Code
14. NEMA National Electrical Manufacturers Association
15. NFPA National Fire Protection Association
16. UL Underwriters Laboratories Inc.

1.06 QUALITY ASSURANCE

A. Substitution of Materials: Refer to Division 1 for equals and substitutions.

1. Where the following conflicts with Division 1, the requirements of Division 1 shall govern.
2. If the Contractor wishes to submit an alternate to the named manufacturers for any equipment, they may submit a voluntary alternative minimum 7 days prior to bid, stating the manufacturer’s name, model number, written, detailed product data.
3. Where materials or equipment are specified by name the proposed material or equipment must be identical to the specified material or equipment in all characteristics of quality, function and serviceability, regardless of application in the Project and, in addition, when the Architect deems that aesthetic significance is important, the equal material or equipment must be identical in all characteristics of visual appearance, design, color and texture. Any proposed equal shall be submitted to Architect/Engineer for prior approval, which Architect/Engineer may approve or disapprove in its sole discretion. Work performed or constructed with unapproved equals is at Contractor’s risk and any required correction of work incorporating unapproved equals shall be at Contractor’s sole cost and expense.
4. In all instances, Contractor shall assume full responsibility for proof of equality of the statute to the equipment hereinafter specified. All data and information necessary for proof of equality, function and space requirements shall be prepared and accompany the submittal of the substitution to the Architect/Engineer. Approval by the Architect/Engineer of equipment other than the specified does NOT relieve Contractor of this responsibility.

B. All products and materials used are to be new, undamaged, clean and in good condition. Existing products and materials are not to be reused unless specifically indicated.

C. Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings, or engineering parameters from those indicated on the contract documents, the contractor is responsible for all costs involved in integrating the equipment or accessories into the system, including, but not limited to, coordination with other trades and any required changes by other trades and for obtaining the intended performance from the system into which these items are placed.

1.07 DESIGN CRITERIA

A. Design fire protection systems in accordance with codes, standards and regulations noted above.

B. The fire protection systems consist of:

1. Automatic wet pipe sprinkler systems.

C. Water Demand Requirements:

1. Hydraulically design automatic sprinkler systems for the hydraulically most remote area based on the following:

Location	Occupancy Classification	Area (Sq. Ft.)	Density (GPM/Sq. Ft.)
Lobbies, Offices, Lounges, Resident Rooms, Toilet Rooms and Similar	Light Hazard	1500	0.10
Custodial, Storage, Mechanical Rooms, Labs and Similar	Ordinary Hazard (Group 1)	1500	0.15
Record Storage, High Density Storage and Similar	Ordinary Hazard (Group 2)	1500	0.20

D. Closely Spaced Sprinklers at Unenclosed Floor Openings (Water Curtain):

1. 3 gpm per lineal foot of floor opening, added to the ceiling water demand at the point of connection. Demand shall be balanced to the higher pressure.

E. Available water supply data for system design is as follows:

1. Information Received: 08/11/2023 12:30 PM
2. Provided By: Nick Griffin – Superintendent – Delavan Public Works

Hydrant Location	Outlet Elevation	Flow GPM	Static Pressure	Residual Pressure
SW Corner of Intersection S 4th St and E Walworth Ave	-	4557	50	20

F. Water test data is preliminary for bidding purposes. Obtain a new flow test for design purposes. Tests shall be representative of high water use periods.

1.08 GUARANTEE

A. Refer to Division 1 for guarantees and warranties. In addition to the requirements in Division 1, this Contractor shall meet the following requirements.

B. In entering into a contract covering this work, the contractor accepts the specifications and guarantees that the work will be carried out in accordance with the requirements of this specification, or such modifications as may be made under the contract documents.

C. Contractor further guarantees that the workmanship and material will be of the best procurable and that none but experienced workmen familiar with each particular class of work will be employed.

D. Contractor further guarantees to replace and make good at their own expense, including travel time, all defects, which may develop within 1 year after final payment and acceptance by the Architect/Engineer, due to faulty workmanship or material, upon, receipt of written notification from the Owner.

1.09 OPERATION AND MAINTENANCE INSTRUCTIONS

A. Refer to Division 1 for operation and maintenance instructions.

B. In addition to the general content specified under Division 1 supply the following additional documentation:

1. Copies of all approved submittals along with approval letters
2. Manufacturer's wiring diagrams for electrically powered equipment
3. Records of tests performed to certify compliance with system requirements
4. Certificates of inspection by regulatory agencies
5. Parts lists for equipment and specialties
6. Manufacturer’s installation, operation and maintenance recommendations for equipment and specialties
7. Valve schedules
8. Lubrication instructions, including list/frequency of lubrication
9. Warranties
10. Copy of NFPA 25 – Standard for Inspection, Testing & Maintenance of Water-Based Fire Protection, latest edition
11. Additional information as indicated in the technical specification sections

1.10 RECORD DOCUMENTS

A. Refer to Division 1 for record documents.

B. In addition to the general content specified under Division 1, follow the following procedures.

1. During the progress of the work, Contractor shall maintain a current (daily) record set of the drawings and specifications, indicating thereon all work installed at variance with such Contract Documents including, without limitation, work covered by Addenda, Field Work Orders, Change Orders and Engineers additional instructions, interpretations and clarification. All changes or deviations from the original layout of the work and all critical dimensions of buried or concealed work shall be recorded. It shall be Contractor’s responsibility to assure that said record sets are complete, accurate and up-to-date, Engineer shall have the right to inspect and review such record sets.
2. At the completion of the work, the Contractor shall indicate on record drawing sets all changes and such additional details as necessary or appropriate to provide a complete reference document for use by Engineer. If variations and details cannot be shown clearly thereon, the Contractor shall prepare supplemental drawings adequate to impart the information. The foregoing drawings collectively shall constitute the “Record” drawings for the work.
3. All indication on “Record” drawings shall be executed in a legible manner at Contractor’s cost, using methods and legend presentations compatible with the overall scheme of the record drawings with respect to scale, drawing sheet sizes and sequential indexing. All changes shall be marked clearly in red and clouded.
4. Engineer may review Contractor’s “Record” drawings and notify Contractor of observed discrepancies or deviations. Contractor shall promptly correct discrepancies, deviations or illegible markups at Contractor’s expense and resubmit revised drawings for Engineer review.
5. Contractor shall provide final electronic record drawings to the Owner through the Engineer.

C. In addition to the data indicated in Division 1, maintain fire protection layout record drawings and hydraulic calculations on originals prepared by the installing contractor/subcontractor.

Include copies of these record drawings and calculations with the Operating and Maintenance manuals.

1.11 CONTINUITY OF EXISTING SERVICES

A. Do not interrupt or change existing services without prior written approval from the Owner's Project Representative. When interruption is required, coordinate scheduling of down-time with the Owner to minimize disruption to his activities. Unless specifically stated, all work involved in interrupting or changing existing services is to be done during normal working hours.

B. Each Contractor shall be thoroughly familiar with existing systems which will affect and be affected by relocation of existing equipment and installation of new lines and equipment. Contractor shall plan installation of their work so interruptions of services to any building or portion thereof will be a minimum and such interruptions shall occur only when system is not required, if possible. If not possible, each Contractor shall insure the operation of services by whatever means possible, such as, installing bypasses, capping of services or providing temporary service. Each interruption shall be for as short a duration as possible.

C. No extra costs will be paid to the Contractor for such outages which must occur outside of regular weekly working hours.

D. Contractor shall restore any circuit interruption as a result of this work to proper operation as soon as possible. Note that institutional operations are on a seven day week schedule.

1.12 PROTECTION OF FINISHED SURFACES

A. Refer to Division 1 for protection of finished surfaces.

1.13 SEALING AND FIRESTOPPING

A. Sealing and firestopping of sleeves/openings between piping, etc. and the sleeve or structural opening shall be the responsibility of the contractor whose work penetrates the opening. The contractor responsible shall hire individuals skilled in such work to do the sealing and fireproofing. These individuals hired shall normally and routinely be employed in the sealing and fireproofing occupation.

B. Contractor shall request current life safety drawings from the Architect/Owner.

1.14 OFF SITE STORAGE

A. If payment will be requested for approved offsite stored material, then the Contractor shall complete an “Offsite Storage Agreement” which is available from the Owner. Prior approval by Owner’s personnel for offsite storage will be needed. No material will be accepted for offsite storage unless submittals for the material have been approved.

1.15 regulatory requirements

A. Comply with requirements of NFPA Standards and local Authority Having Jurisdiction (AHJ) regarding design, materials and installation.

1.16 CERTIFICATES AND INSPECTIONS

A. Refer to Division 1 for permits, regulations, utilities and taxes.

B. Obtain and pay for all required State or local installation inspections except those provided by the Architect/Engineer in accordance with State Code. Deliver originals of these certificates to the Owner. Include copies of the certificates in the Operating and Maintenance Instructions.

C. Coordinate and provide inspections as required by authority having jurisdiction over the site.

1.17 COORDINATION

A. Refer to Division 1 for coordination. In addition to the requirements specified under Division 1, the following requirements apply.

B. It shall be the responsibility of each Contractor to coordinate and consult with each other to determine space requirements and to determine adequate space for servicing is provided

for equipment whether furnished by Contractor or others. General Contractor shall have final decision on all space priority conflicts among Contractors. Space priority conflicts shall be brought to the attention of the Architect/Engineer and Owner's Representative.

C. Each Contractor shall be thoroughly familiar with existing systems which will affect and be affected by relocation of existing equipment and installation of new lines and equipment. They shall plan installation of their work so that interruptions of services to any building or portion thereof will be a minimum, and such interruptions shall occur only when system is not required, if possible. If not possible, each Contractor shall insure the operation of services by whatever means possible, such as, installing bypasses, capping of services, or providing temporary service. Each interruption shall be for as short a duration as possible.

D. Cooperation among all Contractors shall be required. Any Work that is installed without cooperating or coordinating with other Contractors and is in conflict shall be removed and reinstalled at that particular Contractor's expense. No cost additions to the project will be considered due to a Contractor's lack of participation in the cooperation and coordination process. The following list of items of Work shall be the priority of order for all Contractors:

1. Structure
2. Recessed light fixtures
3. Gravity-flow systems for sanitary, storm, steam and steam condensate piping
4. Ductwork and appurtenances
5. Electrical and low voltage cable tray
6. Plumbing vent piping
7. Fire protection (sprinkler system)
8. HVAC piping
9. Medical gas piping
10. Gas piping, process piping and domestic water
11. Electrical conduit and low voltage conduit
12. Control air lines or conduit

E. The above list, in descending order, is the precedence assigned the Work items for space priority. Gravity-flow systems have first priority.

F. Exception: Plumbing lines below or behind plumbing fixtures shall have precedence over all other work. Electrical conduit above or below switchgear, panelboards and control panels shall have precedence over all other work. Do not install any fluid conveying piping over electrical or elevator equipment.

G. In the case of interconnection of the work of two or more contractors, verify at the site or on shop drawings all dimensions relating to such work. All errors due to the failure to so verify any such dimensions shall be promptly rectified.

H. Any installed work that is not coordinated and interferes with another contractor’s work shall be removed or relocated at the installing contractor’s expense.

I. Prior to start of Construction, the General Contractor shall schedule a meeting with all of the Contractors responsible for the work items listed above. The purpose of the meeting is to introduce the coordination program and to determine its implementation in relation to the progress schedule.

J. At the initial Coordination Meeting, the Mechanical Contractor / Ventilating Contractor shall provide to the General Contractor outline drawings at 1/4" scale indicating column centerlines, interior partition locations, and ceiling heights. The General Contractor shall verify all information shown on these drawings and relay any changes in the information to the Ventilation Contractor to be reflected on the Drawings. The Ventilating Contractor, with reference and consideration to the Structural, Heating, Electrical, Fire Protection, and

Plumbing Drawings, shall draw to scale his proposed installation showing duct sizes, equipment layouts, and dimensions from column lines and from finished floors to bottom of ducts. Ductwork shall be maintained as tightly as possible to the underside of floor slabs and/or beams. For congested areas the Ventilating Contractor shall, in addition, prepare Drawings in section view. During this phase of the program, it shall be the Electrical Contractor's responsibility to furnish the Ventilating Contractor with recessed lighting installation and clearance requirements. This information shall be outlined on the Drawings by the Ventilating Contractor.

K. The ductwork layouts shall be produced in sequence as mandated by the Project Schedule. The earliest area indicated in the Schedule shall receive the first effort, etc.

L. When the Ductwork Drawings for the earliest scheduled area have been completed (time limitation as determined at the initial coordination meeting), the Ventilating Contractor shall provide the General Contractor with one set of drawings for each participant in the effort. The General Contractor will distribute the drawings to the participating Contractors for their use in drawing thereon the major components of their proposed installation using the general scheme shown on the Contract Drawings as a guide.

M. The major components to be indicated include (but are not limited to) the following:

1. Structure
2. Roof drain leaders
3. Above 3” waste piping
4. Sprinkler mains
5. Heating hot water mains
6. Chilled water mains
7. Conveying systems
8. Significant conduit runs
9. Cable trays
10. Contract ceiling heights
11. Soffits
12. Access points
13. Fire wall penetrations
14. Steam and condensate mains
15. Gas, water, and process piping

N. Information delineated shall be distance from column centerlines, pipe/equipment size, and distance from finished floor to bottom of pipe/equipment and hangers. Included on the Drawings shall be piping layout with hanger locations and hanger point loads. This information shall be developed satisfactorily enough to allow the Structural Engineer to verify the adequacy of the structural system for the projected loads. The hanger locations may have to be moved depending on the structural system review. No hanger shall be fabricated and/or installed until the hanger locations are reviewed and accepted by the Architect/Engineer.

O. Within a period not to exceed two weeks after distribution of the drawings, the General Contractor will schedule a meeting with the Architect/Engineer and participating Contractors at which time areas of conflict shall be resolved. The drawings shall be overlaid to identify areas of conflict. All parties shall then cooperate in resolving the conflicts. Records of the agreements shall be entered on the Ventilating Contractor's drawings, acknowledged by all participants by signature in space provided for this purpose, and two copies distributed to all involved parties. All coordination drawing preparation and reproduction costs shall be

borne by the Ventilating Contractor. The above drawings, review, and coordination process shall be repeated until all areas on the Project have been coordinated.

P. In the event a Contractor fails to cooperate in the Coordination Program, they shall be held responsible for all costs incurred for adjustments to the work of others made necessary to accommodate the uncooperative Contractor's installations.

1.18 DEMOLITION AND EXISTING REQUIREMENTS

A. Existing active services: water, gas, medical gas, steam, ventilation, compressed or control air, sanitary waste, sanitary vent, storm electric, and any other building systems when encountered shall be protected against damage. Where existing services are to be abandoned, the services shall be removed back to the point of origin and removed from the site unless otherwise directed by the Owner's Representative.

B. Submit a “Sequence of Work Schedule” in respect to all temporary and permanent utility and service cutovers after final determination. This schedule shall be submitted for approval to the Owner and Architect/Engineer. The submittal shall designate priority order, service or utility affected, date of cutover, and time of day to start and finish.

C. Bidders should inspect the site to become familiar with conditions of the site which will affect the Work. Bidders should verify points of connection with utilities, routing of outside piping to include required clearances from any existing structures, or other obstacles.

D. Extra payment will not be allowed for changes in the Work required because of the successful bidder's failure to make this inspection.

1.19 REQUEST AND CERTIFICATION FOR PAYMENT

A. Within 10 days after Notice to Proceed, the successful bidder will submit to the Owner’s Project Representative in a form prescribed by Division 1, a cost breakdown of the proposed values for work performed which, if approved by the owner, will become the basis for construction progress and monthly payments. The cost breakdown items shall reflect actual work progress stages as closely as feasible.

B. In addition, if payment is requested for approved off-site stored material, then that material shall be listed as a line item in the request and certification for payment cost breakdown.

1.20 sleeves and openings

A. Openings required in new or existing construction that may be necessary for the installation of new work shall be provided by the respective contractor and all patching and repairing shall be done by workmen competent in the trade required, at the expense of the respective contractor. The respective contractor shall be responsible for arranging the work so that minimum cutting will be required. All rubbish and excess materials involved in such cutting shall be promptly removed from the site and disposed of by the contractor. Cutting through the floor or roof systems or load bearing walls shall be done only with the prior written approval of the Architect/Engineer so as to avoid damaging the structural system.

1.21 OMISSIONS

A. No later than ten (10) days before bid opening, the Contractor shall call the attention of the A/E to any materials or apparatus the Contractor believes to be inadequate and to any necessary items of work omitted.

1.22 DEFINITIONS

A. Wherever the words “the Contractor”, “this Contractor” or “Fire Protection Contractor” appear in this division, they refer to the Contractor for Fire Protection work.

B. The term “provide” includes such labor, methods, materials, equipment and transportation or other facilities required to complete the Contract and the performance of all duties thereby upon the Contractor.

1.23 PROJECT/SITE CONDITIONS

A. Install Work in locations shown on Drawings, unless prevented by Project conditions.

B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of A/E before proceeding.

C. Tools, materials and equipment shall be confined to areas designated by the Owner's project representative.

1.24 WORK SEQUENCE AND SCHEDULING

A. Install work in phases to accommodate Owner's occupancy requirements. During the construction period coordinate schedule and operations with Owner's Construction Representatives.

1.25 SALVAGE MATERIALS

A. No materials removed from this project shall be reused (except as specifically noted below). All materials removed shall become the property of and shall be disposed of by the Contractor.

1.26 TRAINING

B. The contractor shall have the following responsibilities:

1. Provide a training plan sixty days before the planned training covering the following elements:
   a. Equipment
   b. Intended audience
   c. Location of training
   d. Objectives
   e. Subjects covered (description, duration of discussion, special methods, etc.)
   f. Duration of training on each subject
   g. Instructor for each subject
   h. Methods (classroom lecture, manufacturer's quality video, site walk-through, actual operational demonstrations, written handouts, etc.).
2. Provide designated owner personnel with comprehensive orientation and training in the understanding of the systems and the operation and maintenance of each piece of equipment that makes up the system.
3. Training shall normally start with classroom sessions followed by hands-on demonstration/training on each piece of equipment.
4. During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system shall be repaired or adjusted as necessary and the demonstration repeated at another scheduled time, if necessary.
5. The appropriate trade or manufacturer's representative shall provide the instructions on each major piece of equipment. Practical building operating expertise as well as in-depth knowledge of all modes of operation of the specific piece of equipment are required. More than one party may be required to execute the training.
6. The controls contractor shall attend sessions other than the controls training, as specified, to discuss the interaction of the controls system as it relates to the equipment being discussed.
7. The training sessions shall follow the outline in the table of contents of the operation and maintenance manual and illustrate whenever possible the use of the O&M manuals for reference.
8. Training shall include:

a. Use of the printed installation, operation and maintenance instruction material included in the O&M manuals.

b. A review of the written O&M instructions emphasizing safe and proper operating requirements, preventative maintenance, special tools needed and spare parts inventory suggestions. The training shall include startup, operation in all modes possible, shutdown, seasonal changeover and any emergency procedures.

c. Discussion of relevant health and safety issues and concerns.

d. Discussion of warranties and guarantees.

e. Common troubleshooting problems and solutions.

f. Explanatory information included in the O&M manuals.

g. Discussion of any peculiarities of equipment installation or operation.

h. Classroom sessions shall include the use of overhead projections, slides, video/audio-taped material as might be appropriate.

i. Hands-on training shall include startup, operation in all modes possible, including manual, shut-down, alarms, power failure and any emergency procedures, and preventative maintenance for all pieces of equipment.

9. The contractor shall fully explain and demonstrate the operation, function and overrides of any local packaged controls not controlled by the central control system.

C. Video recording of the training sessions will be provided by the contractor and added to the O&M manuals. In addition, factory training videos identifying key troubleshooting, repair, service and/or replacement techniques shall be provided and reviewed with the owner.

D. Provide a minimum of 4 hours of instruction.

E. Provide additional training as specified in other specification sections for specific equipment.

PART 2 – PRODUCTS

2.01 ACCESS PANELS AND DOORS

A. Lay-in Ceilings: Removable lay-in ceiling tiles in 2 x 2 foot or 2 x 4 foot configuration provided under Division 09 are sufficient; no additional access provisions are required unless specifically indicated.

B. Masonry Walls, Gypsum Board and Plaster Walls and Ceilings: 16 gauge frame with not less than a 20 gauge hinged door panel, prime coated steel for general applications, stainless steel for use in toilets, showers, and similar wet areas, concealed hinges, screwdriver operated cam latch for general applications, key lock for use in public areas, UL listed for use in fire rated partitions if required by the application. Use the largest size access opening possible, consistent with the space and the equipment needing service; minimum size is 12" by 12".

2.02 IDENTIFICATION

A. Adhesive Labels: Pressure-sensitive, adhesive backed, vinyl pipe markers with applicable labeling, ¾” min. size for lettering and surrounding tape on both ends. With flow arrows on piping. Conforming to ANSI, ANSI and NFPA standards.

B. Snap-Around Markers: One-piece, pre-formed, vinyl construction, snap-around or strap-around pipe markers with applicable labeling, ¾” min. size for lettering. Provide nylon ties on each end of pipe marker.

C. Signs: Permanently marked weatherproof metal or rigid plastic sign conforming to NFPA 13, secured with corrosion-resistant wire, chain, or other means.

1. Engraved Name Plates: White letters on a black background, 1/16” thick plastic laminate, beveled edges, screw mounting.

D. Valve Tags: Round brass tags with ½" numbers, ¼" system identification abbreviation, 1¼" minimum diameter, with brass jack chains with brass "S" hooks or one piece nylon ties around the valve stem.

2.03 SLEEVES AND OPENINGS

A. General:

1. Pipe sleeves shall be constructed of standard weight ASTM A53 or ASME B36.10 steel with an anchor plate constructed of A36/A36M steel welded to the pipe. The sleeve shall be sized a minimum of 1" larger than piping insulation diameter. The entire assembly shall be hot-dip galvanized after fabrication.
2. Duct sleeves and piping sleeves passing through interior walls shall be constructed of 24 gauge galvanized steel minimum thickness.

B. Sleeves Through Below Grade Walls:

1. Provide steel pipe sleeve, ASTM A53, pressure sealing with membrane clamp ring, gasket, water stop ring, external rings, and nitrile rubber link seals. The assembly shall be hot-dip galvanized after fabrication.
   a. Seals: Modular mechanical type seals, consisting of interlocking nitrile rubber links shaped to continuously fill the annular space between the pipe and the sleeve and electrically isolate the carrier pipe from the steel sleeve.
   b. Sealing Element: Polychloroprene rubber material compounded to resist aging, ozone, sunlight, hydrocarbon gases, water, and chemical action.
   c. Hardware: Type 300 series stainless steel fasteners. Threads rolled to produce smooth uniform threads and unbroken flow lines.
   d. Compression Plates: Fiberglass-reinforced polyester plastic, injection molded for high physical properties, dielectric strength and non-cold flow creep characteristics, having high resistance to acidic and alkaline soils.
2. For sleeves located 15 feet or more below grade provide cast iron sleeve ASTM A74 with compression seals.

2.04 SEALING AND FIRESTOPPING

A. Fire and/or Smoke Rated Penetrations

1. Manufacturers: 3M, Hilti, STI/SpecSeal, Tremco.
2. All firestopping systems shall be provided by the same manufacturer.
3. Fire stop systems shall be UL listed or tested by an independent testing laboratory approved by the Authority Having Jurisdiction (AHJ).
4. Submittals: Contractor shall submit product data for each firestop system. Submittals shall include product characteristics, performance and limitation criteria, test data, MSDS sheets, installation details and procedures for each method of installation applicable to this project. For non-standard conditions where no UL tested system exists, submit manufacturer's drawings for UL system with known performance for which an engineering judgment can be based upon
5. Use a product that has a rating not less than the rating of the wall or floor being penetrated. Reference architectural drawings for identification of fire and/or smoke rated walls and floors.
6. Use firestop putty, caulk sealant, intumescent wrapstrips, intumescent firestop collars, firestop mortar or a combination of these products to provide a UL listed system for each application required for this project. Provide mineral wool backing where specified in manufacturer's application detail.
7. All sealants shall meet the intent of LEED® VOC requirements, <250 g/L VOC contents (less H_20 and exempt solvents).

B. Non-Rated Penetrations:

1. Pipe Penetrations Through Below Grade Walls: In exterior wall openings below grade, use a modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and the cored opening or a water-stop type wall sleeve. The operating bolts of the mechanical type seal shall be accessible from the building interior.
2. Pipe Penetrations: At pipe penetrations of non-rated interior partitions, floors and exterior walls above grade use urethane caulk in annular space between pipe and sleeve. For non-rated drywall, plaster or wood partitions where sleeve is not required use urethane caulk in annular space between pipe insulation and wall material.

PART 3 – EXECUTION

3.01 DEMOLITION

A. Perform all demolition as indicated on the drawings to accomplish new work. Where demolition work is to be performed adjacent to existing work that remains in an occupied area, construct temporary dust partition to minimize the amount of contamination of the occupied space. Where pipe is removed and not reconnected with new work, cap ends of existing services as if they were new work. Coordinate work with the Owner to minimize disruption to the existing building occupants.

B. All pipe, sprinklers, equipment, wiring, associated conduit and similar items demolished, abandoned, or deactivated are to be removed from the site by the Contractor except as specifically noted otherwise. All designated equipment is to be turned over to the Owner at a place and time designated. Maintain the condition of material and/or equipment that is indicated to be reused equal to that existing before work began.

C. All contractors requiring the personnel/ material hoist and or temporary construction elevator (i.e. new elevators, temporarily protected) at times other than outlined in the temporary facilities specifications will make arrangements directly with the general contractor. The general contractor is responsible for all coordination and scheduling of the use of any hoisting equipment, so the flow of the project is smoothly maintained, and all workers have access to the work areas to perform their work and deliver material to the areas needed according to the project schedule.

D. If any contractor’s work requires the removal and replacement of any finished materials including but not limited to such materials as ceiling tiles, wall finishes, cabinets, doors, flooring, windows, etc. after those items are installed, each contractor will be responsible, at no additional cost to the owner, to replace any damaged, soiled or lost materials with new materials to match the existing materials and those materials damaged.

3.02 CONCRETE WORK

A. Cast-in-place concrete within the building will be performed by the Division 3 Contractor. Provide all layout drawings, anchor bolts, metal shapes, and/or templates required to be cast into concrete or used to form concrete for support or installation of piping, specialties and equipment. Coordinate locations of equipment, pipe penetrations in wet areas, etc. with the Division 3 Contractor.

3.03 CUTTING AND PATCHING

A. Refer to Division 1 for cutting and patching. In addition to the requirements in Division 1:

B. Each Contractor shall coordinate the placing of openings in the new structure as required for the installation of each Contractor’s work.

C. Each Contractor shall furnish to the General Contractor the accurate locations and sizes for required openings in the new work, but this shall not relieve each Contractor of the responsibility of checking to assure that properly sized openings are provided. When additional patching is required due to the Contractor's failure to inspect this work, then the Contractor shall make arrangements for the patching required to properly close the

openings to include patch painting, and the Contractor shall pay any additional cost incurred in this respect.

D. If cutting and patching of the new structure is made necessary due to the Contractor's failure to install piping, ducts, sleeves, or equipment on schedule, or due to the Contractor's failure to furnish on schedule the information required for the leaving of openings, then it shall be the Contractor's responsibility to make arrangements and obtain approval from the General Contractor and Architect/Engineer for this cutting and patching, and the Contractor shall pay any additional cost incurred in this respect. The Contractor shall also reimburse the Owner for any additional costs incurred to the Architect/Engineer for additional services caused by the Contractor in this respect.

E. The Contractor shall provide cutting and patching and patch painting in the existing structure as required for the installation of their work and shall furnish lintels and supports as required for openings. Cutting of structural support members will not be permitted without prior approval of the Architect/Engineer. Extent of cutting shall be minimized; use core drills, power saws, or other machines which will provide neat, minimum openings. Patching shall match adjacent materials and surfaces and shall be performed by craftsmen skilled in the respective craft required.

3.04 LINTELS

A. All steel lintels required for opening in existing and/or new masonry walls shall be provided under Section 05 50 00 – Metal Fabrications. This contractor shall design, fabricate, and install all lintels required in masonry walls for duct and pipe penetrations. Contractor shall submit design drawings of lintels with professional engineers' seal and signature prior to installation.

3.05 BUILDING ACCESS

A. Arrange for the necessary openings in the building to allow for admittance of all apparatus. When the building access was not previously arranged and must be provided by this contractor, restore any opening to its original condition after the apparatus has been brought into the building.

3.06 EQUIPMENT ACCESS

A. Install all piping, conduit and accessories to permit access to equipment for maintenance and service. Coordinate the exact location of wall and ceiling access panels and doors with the General Contractor, making sure that access is available for all equipment and specialties. Access doors in general construction are to be furnished by the Fire Protection Contractor and installed by the General Contractor.

B. Provide color coded thumb tacks or screws, depending on the surface, for use in accessible ceilings which do not require access panels.

3.07 COORDINATION

A. Coordinate all work with other contractors prior to installation. Any work that is not coordinated and that interferes with other contractor's work shall be removed or relocated at the installing contractor's expense.

B. Verify that all devices are compatible for the type of construction and surfaces on which they will be used.

3.08 IDENTIFICATION

A. Identify equipment in mechanical equipment rooms with engraved name plates.

B. Identify interior piping mains 2½" and larger not less than once every 25 feet, not less than once in each room, adjacent to each access door or panel, and on both sides of the partition where exposed piping passes through walls or floors. Place flow directional arrows at each pipe identification location.

C. Provide hydraulic design information sign of permanently marked weatherproof metal or engraved nameplate material. Secure to system risers. Information to include location of the

design areas, discharge densities, required flow and residual pressure at the base of riser, hose stream demand and sprinkler demand.

3.09 LUBRICATION

A. Lubricate all bearings with lubricant as recommended by the manufacturer before the equipment is operated for any reason. Once the equipment has been run, maintain lubrication in accordance with the manufacturer's instructions until the work is accepted by the Owner. Maintain a log of all lubricants used and frequency of lubrication; include this information in the Operating and Maintenance Manuals at the completion of the project.

3.10 SLEEVES AND OPENINGS

A. General:

1. Sleeves are not required for piping and ducts passing through interior non-rated drywall, plaster, or wood partitions and interior poured concrete walls that have been saw cut or core drilled.
2. Pack annular space between sleeves and pipe or ducts with fiberglass insulation and seal.
3. Piping sleeves that pass through fire rated floors, walls, or ceilings shall be provided with a UL listed fire stop material meeting UL 1479 to seal the opening between the pipe and the pipe sleeve to maintain the fire rating.
4. Provide escutcheon plates on piping to cover sleeve and insulation in finished areas.
5. Refer to Division 1 for additional information on sleeves and openings.

B. Sleeves Through Floors/Ceilings:

1. Sleeves shall be installed to extend 1 inch above finished floor with a watertight sealant between floor and sleeve in all mechanical rooms and wet rooms listed below.
2. If a sleeve is not provided, provide 1-1/2 inch angle ring with urethane caulk between the angle and the floor and seal at the corners to form a watertight seal.
3. Wet Locations:
   a. Mechanical rooms
   b. Sanitary pumping stations
   c. Food service/kitchen areas (behind/under equipment, cabinets, tables, etc.)

3.11 SEALING AND FIRESTOPPING

A. The Contractor shall refer to building life safety drawings for all smoke and fire rates in addition to the mechanical drawings. Any discrepancies shall be brought to the attention of the Architect/Engineer before final addendum.

B. Fire and/or Smoke Rated Penetrations:

1. Install approved product in accordance with the manufacturer's instructions where a pipe penetrates a fire/smoke rated surface.
2. Where firestop mortar is used to infill large fire-rated floor openings that could be required to support weight, provide permanent structural forming. Firestop mortar alone is not adequate to support substantial weight.

C. Non-Rated Partitions:

1. In exterior wall openings below grade, assemble rubber links of mechanical seal to the proper size for the pipe and tighten in place, in accordance with manufacturer's instructions.
2. At all interior partitions and exterior walls, pipe penetrations are required to be sealed. Apply sealant to both sides of the penetration in such a manner that the annular space between the pipe sleeve or cored opening and the pipe is completely blocked.

3.12 HOUSEKEEPING AND CLEAN UP

A. The Contractor shall clean up and remove from the premises, on a daily basis, all debris and rubbish resulting from its work and shall repair all damage to new and existing equipment resulting from its work. When job is complete, this Contractor shall remove all tools, excess material and equipment, etc., from the site.

END OF SECTION

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SECTION 21 05 29

HANGERS AND SUPPORTS FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Base Bid: Unless noted otherwise, the Fire Protection Contractor shall provide all labor and materials for a complete system in this specification section.

1.02 SECTION INCLUDES

A. This section includes specifications for supports of all fire suppression equipment and materials.

1. Pipe Hangers And Supports
2. Pipe Hanger Rods
3. Beam Clamps
4. Concrete Inserts
5. Equipment Stands
6. Corrosive Atmosphere Coatings

1.03 RELATED WORK

A. Applicable provisions of Division 1 shall govern work under this section.

B. Section 21 05 00 – Common Work Results for Fire Suppression

C. Section 21 10 00 – Water-Based Fire Suppression Systems

D. Division 3 – Concrete

1.04 SUBMITTALS

A. Refer Section 21 05 00 – Common Work Results for Fire Suppression, Submittals. In addition to the general content specified under Section 21 05 00 – Common Work Results for Fire Suppression, supply the following submittals:

1. Pipe Hangers And Supports
2. Pipe Hanger Rods
3. Beam Clamps
4. Concrete Inserts
5. Equipment Stands
6. Corrosive Atmosphere Coatings

B. Schedule of all hanger and support devices indicating attachment methods and type of device for each pipe size and type of service. Provide details on the working drawings submitted for approval with all pertinent information listed.

1.05 REFERENCE STANDARDS

A.	MSS SP-58	Pipe Hangers and Supports – Materials, Design, Manufacture, Selection, Application, And Installation
B.	NFPA 13	Installation of Sprinkler Systems (Latest edition)
C.	NFPA 14	Installation of Standpipe and Hose Systems (Latest edition)
D.	NFPA 20	Installation of Stationary Pumps for Fire Protection (Latest edition)
E.	UL	Underwriters' Laboratories
F.	FM	FM Global

1.06 QUALITY ASSURANCE

A. Substitution of Materials Refer to Division 1 for equals and substitutions.

1.07 DESIGN CRITERIA

A. Materials and application of pipe hangers and supports shall be in accordance with MSS Standard Practice SP-58 unless noted otherwise.

B. Materials and application of pipe hangers and supports shall be in accordance with NFPA and be UL/FM listed and approved.

1.08 DESCRIPTION

A. Provide all supporting devices as required for the installation of equipment and materials. All supports and installation procedures are to conform to the latest requirements of the ANSI Code for building piping.

B. Do not hang any fire suppression item directly from a metal deck or run piping so its rests on the bottom chord of any truss or joist.

C. Fasteners depending on soft lead for holding power or requiring explosive powder actuation will not be accepted.

D. Support apparatus and material under all conditions of operation, variations in installed and operating weight of equipment and piping, to prevent excess stress, and allow for proper expansion and contraction.

PART 2 - PRODUCTS

2.01 PIPE HANGERS AND SUPPORTS

A. Manufacturers: Cooper/B-Line, Anvil, Pate, Piping Technology, Roof Products & Systems

B. Hangers for Pipe Sizes ½” through 4":

1. Carbon steel, adjustable swivel ring with 3/8" min. UL/FM approved hanger rods.
2. Carbon steel, adjustable clevis, standard, with UL/FM approved size hanger rods.

C. Hangers for Pipe Sizes 4" Through 8":

1. Carbon steel adjustable swivel ring with ½" min. UL/FM approved hanger rods.
2. Carbon steel, adjustable clevis, standard with UL/FM approved size hanger rods.

D. Wall Support:

1. Carbon steel welded bracket with hanger.
2. Steel channels with pipe clamps.

E. Vertical Support:

1. Carbon steel riser clamp.

F. Floor Support:

1. Carbon steel pipe saddle, stand and bolted floor flange.

G. Copper Pipe Supports:

1. All supports, fasteners, clamps, etc. directly connected to copper piping shall be copper plated or polyvinylchloride coated. Where steel channels are used, provide flexible elastomeric/thermoplastic isolation cushion material to completely encircle the piping and avoid contact with the channel or clamp or provide manufacturers clamp and cushion assemblies.
2. Where copper pipe is used for its non-magnetic properties, for example above MRI magnet room, supports, fasteners, clamps, and hanger rods are also to be non-magnetic, Type 304 or 316 austenitic stainless steel, with flexible elastomeric/thermoplastic isolation cushion between pipe and support.

2.02 PIPE HANGER RODS

A. Steel Hanger Rods:

1. Threaded both at ends, threaded one end, or continuously threaded, complete with adjusting and lock nuts.

B. Size rods for individual hangers and trapeze support as indicated in the following schedule.

Pipe Size	Minimum Diameter of Rod
4" and Smaller	3/8" or 10 mm
5", 6" and 8"	½" or 13 mm
10" and 12"	5/8" or 16 mm

2.03 BEAM CLAMPS

A. MSS SP-58 Types 19 & 23 malleable black iron clamp for attachment to beam flange to 0.62 inches thick with a retaining ring and threaded rod of 3/8, 1/2, and 5/8 inch diameter. Furnish with a hardened steel cup point set screw.

B. MSS SP-58 Type 28 or Type 29 forged steel jaw type clamp with a tie rod to lock clamp in place, suitable for rod sizes to 1 ½" diameter.

2.04 CONCRETE INSERTS

A. Poured in Place:

1. MSS SP-58 Type 18 wedge type to be constructed of a black carbon steel body with a removable malleable iron nut that accepts threaded rod to 7/8 inch diameter. Wedge design to allow the insert to be held by concrete in compression to maximize the load carrying capacity.
2. MSS SP-58 Type 18 universal type to be constructed of black malleable iron body with a removable malleable iron nut that accepts threaded rod to 7/8 inch diameter.

B. Drilled Fasteners:

1. Carbon steel expansion anchors, vibration resistant, with ASTM B633 zinc plating. Use drill bit of same manufacturer as anchor.

2.05 EQUIPMENT STANDS

A. Use structural steel members welded to and supported by pipe supports. Clean, prime and coat with three coat rust inhibiting alkyd paint or one coat epoxy mastic. Where exposed to weather, treat with corrosive atmosphere coatings.

2.06 CORROSIVE ATMOSPHERE COATINGS

A. Factory coat supports and anchors used in corrosive atmospheres with hot dip galvanizing after fabrication, ASTM A123, 1.5 ounces/square foot of surface each side. Mechanical galvanize threaded products, ASTM B695 Class 50, 2.0 mil coating. Field cuts and damaged finishes to be field covered with zinc rich paint of comparable thickness to factory coating.

B. Corrosive atmospheres include the following locations:

1. Exterior locations
2. Sanitary pumping stations
3. Food service/kitchen areas

PART 3 - EXECUTION

3.01 INSTALLATION

A. Size, apply and install supports in compliance with manufacturer's recommendations.

B. Install supports to provide for free expansion of the piping system. Support all piping from the structure using concrete inserts, beam clamps, ceiling plates, wall brackets, or floor stands.

Fasten ceiling plates and wall brackets securely to the structure and test to demonstrate the adequacy of the fastening.

C. Select and install hangers and supports in conformance with NFPA standards.

D. Perform welding in accordance with standards of the American Welding Society.

3.02 HANGER AND SUPPORT SPACING

A. Except where permitted by NFPA there shall be not less than one hanger for each section of pipe.

B. Use hangers with minimum 1½" vertical adjustment.

C. Support riser piping independently of connected horizontal piping.

D. Adjust hangers to obtain the slope specified in the piping section of these specifications.

E. Space hangers for pipe as follows:

Pipe Material	Pipe Size	Max. Horiz. Spacing	Max. Vert. Spacing
Copper	¾" through 1"	8'-0"	10'-0"
Copper	1 ¼" through 1 ½"	10'-0"	10'-0"
Copper	2" through 3"	12'-0"	10'-0"
Copper	3 ½" through 8"	15'-0"	10'-0"
Steel	1" through 1 ¼"	12'-0"	15'-0"
Steel	1 ½" through 8"	15'-0"	15'-0"

F. Unsupported length from the last hanger and an end sprinkler shall be as follows:

1. 1" piping — Not greater than 36"
2. 1 ¼" piping — Not greater than 48"
3. 1 ½" piping or larger — Not greater than 60"

3.03 RISER CLAMPS

A. Support vertical piping with clamps secured to the piping and resting on the building structure or secured to the building structure below at each floor.

END OF SECTION

SECTION 21 10 00
WATER-BASED FIRE SUPPRESSION SYSTEMS

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Base Bid: Unless noted otherwise, the Fire Protection Contractor shall provide all labor and materials for a complete system in this specification section.

1.02 SECTION INCLUDES

A. This section contains specifications for fire suppression pipe, pipe fittings, sprinklers, valves, switches and related items for automatic sprinkler and standpipe systems in this project.

1. Fire Protection Piping
2. Unions and Flanges
3. Mechanical Grooved Pipe Connections
4. Sprinklers
5. Flexible Sprinkler Connections
6. Switches
7. Local Alarm Horn/Strobe
8. Pressure Gauges
9. Valves
10. Double Check Backflow Prevention Assembly
11. Specialties
12. Dry Valves
13. Fire Department Connection
14. Air Compressor
15. Dry Nitrogen Supply System

1.03 RELATED WORK

A. Applicable provisions of Division 1 govern work under this section.

B. Section 21 05 00 – Common Work Results for Fire Suppression

C. Section 21 05 29 – Hangers and Supports for Fire Suppression Piping and Equipment

1.04 SUBMITTALS

A. Refer Section 21 05 00 – Common Work Results For Fire Suppression, Submittals. In addition to the general content specified under Section 21 05 00 – Common Work Results For Fire Suppression, supply the following submittals:

1. Fire Protection Piping
2. Unions and Flanges
3. Mechanical Grooved Pipe Connections
4. Sprinklers
5. Flexible Sprinkler Connections
6. Switches
7. Local Alarm Horn/Strobe
8. Pressure Gauges
9. Valves
10. Double Check Backflow Prevention Assembly

11. Specialties
12. Dry Valves
13. Fire Department Connection
14. Air Compressor
15. Dry Nitrogen Supply System

B. Schedule from the contractor indicating the ANSI/ASTM specification number of the pipe being proposed along with its type and grade, if known at the time of submittal, and sufficient information to indicate the type and rating of fittings for each service.

1.05 REFERENCE STANDARDS

A. ANSI A21.4
B. ANSI A21.11
C. ANSI A21.51
D. ANSI B16.1 Cast Iron Pipe Flanges and Flanged Fittings
E. ANSI B16.3 Malleable Iron Threaded Fittings
F. ANSI B16.4 Cast Iron Threaded Fittings
G. ANSI B16.5 Pipe Flanges and Flanged Fittings
H. ANSI B16.9 Factory Made Wrought Steel Buttweld Fittings
I. ANSI B16.11 Forged Steel Fittings, Socket Welded and Threaded
J. ANSI B16.18 Cast Bronze Solder Joint Pressure Fittings
K. ANSI B16.22 Wrought Copper and Wrought Copper Alloy Solder Joint Pressure Fittings
L. ANSI B16.29 Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings-DWV
M. ASTM A53 Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless
N. ASTM A105 Forgings, Carbon Steel, for Piping Components
O. ASTM A126 Gray Cast Iron Castings for Valves, Flanges, and Pipe Fittings
P. ASTM A135 Electric Resistance Welded Steel Pipe
Q. ASTM A181 Forgings, Carbon Steel for General Purpose Piping
R. ASTM A234 Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
S. ASTM A536 Ductile Iron Castings
T. ASTM A795 Black and Hot Dipped Zinc Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use
U. ASTM B88 Seamless Copper Water Tube
V. AWS A5.8 Brazing Filler Metal
W. AWS D10.9 Qualification of Welding Procedures and Welders for Piping and Tubing, Level AR3
X. NFPA 13 Installation of Sprinkler Systems. (Latest edition)
Y. NFPA 14 Installation of Standpipe and Hose Systems. (Latest edition)
Z. UL Underwriters' Laboratories
AA. FM FM Global

1.06 QUALITY ASSURANCE

A. Substitution of Materials: Refer to Division 1 for equals and substitutions.

B. Order all pipe with each length marked with the name or trademark of the manufacturer and type of pipe; with each shipping unit marked with the purchase order number, metal or alloy designation, temper, size, and name of supplier.

C. Any installed material not meeting the specification requirements must be replaced with material that meets these specifications without additional cost to the Owner.

1.07 DESIGN CRITERIA

A. Use only new material, free of defects, rust and scale, and meeting the latest revision of ASTM specifications as listed in this specification.

B. Construct all piping systems for the highest pressures and temperatures in the respective system but not less than 175 psig.

C. Where ASTM A53 or A795 type F pipe is specified, grade A type E or S, or grade B type E or S may be substituted at Contractor's option. Where ASTM A135 grade A pipe is specified, grade B pipe may be substituted at Contractor's option. Where the grade or type is not specified, Contractor may choose from those commercially available.

D. Where ASTM B88, type L H (drawn) temper copper tubing is specified, ASTM B88, type K H (drawn) temper copper tubing may be substituted at contractor's option.

E. Where CPVC pipe is specified, it is allowed only in wet pipe systems.

1.08 DELIVERY, STORAGE AND HANDLING

A. Promptly inspect shipments to ensure that the material is undamaged and complies with specifications.

B. Cover pipe to prevent corrosion or deterioration while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade. Protect pipe, tube, and fitting ends so they are not damaged. Where end caps are provided or specified, take precautions so the caps remain in place. Protect fittings, flanges, and unions by storage inside or by durable, waterproof, above ground packaging.

C. Storage and protection methods must allow inspection to verify products.

1.09 WELDER QUALIFICATIONS

A. Welding procedures, welders, and welding operators for all building service piping to be in accordance with certified welding procedures of the National Certified Pipe Welding Bureau and Section 927.5 of ASME B31.9 Building Services Piping or AWS 10.9 Qualification of Welding Procedures and Welders for Piping and Tubing. Before any metallic welding is performed, Contractor to submit their Standard Welding Procedure Specification together with the Procedure Qualification Record as required by Section 927.6 of ASME B31.9 Building Services Piping.

B. The Architect or Engineer reserves the right to test the work of any welder employed on the project, at the Owner's expense. If the work of the welder is found to be unsatisfactory, the welder shall be prevented from doing further welding on the project and all defective welds replaced.

PART 2 – PRODUCTS

2.01 FIRE PROTECTION PIPING

A. Steel Pipe:

1. Black steel pipe welded and seamless, Type F, Grade A, ASTM A53; black welded and seamless steel pipe for fire protection use, Type F, ASTM A795; electric resistance welded steel pipe, Grade A, ASTM A135.
2. Unscheduled specialty steel pipe is not acceptable.
3. Pipe Wall Thickness: Schedule 40 for welded, rolled groove, cut groove and threaded. Schedule 30 for welded, rolled groove, 8" and larger cut groove and 8" and larger threaded piping. Schedule 10 up to and including 6" for rolled groove and welded.

4. Fittings: 2" and Smaller - Cast iron threaded fittings, Class 125 or 250, ASTM A126/ANSI B16.4. Malleable iron threaded fittings, Class 150 or 300, ASTM A197/ANSI B16.3. Standard weight seamless carbon steel weld fittings, ASTM A234 grade, ANSI B16.9. Mechanical grooved fittings with EPDM gaskets, ASTM A536 ductile iron, ASTM A47 malleable iron or ASTM A53 fabricated steel.
5. Welding Materials: Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials.
6. Finish: Hot dipped zinc coated (galvanized) finish on piping and fittings shall be used in dry sprinkler or combined pipe systems, pre-action systems, piping exposed to weather and piping exposed to corrosive environments where indicated. Thread or cut groove hot dipped zinc coated pipe ends for fitting connections. Indoor dry standpipe systems supplied by a Fire Dept. connection only may be black steel piping and fittings.

B. Copper Pipe:

1. Type L copper water tube, H (drawn) temper, ASTM B88; with cast copper pressure fittings, ANSI B16.18; wrought copper pressure fittings, ANSI B16.22; copper phosphorous brazing alloy, AWS A5.8 BCuP. Mechanically formed brazed tee connections may be used in lieu of specified tee fittings for branch takeoffs up to one-half (1/2) the diameter of the main.

C. Chlorinated Polyvinyl Chloride Pipe will not be allowed for this project.

2.02 UNIONS AND FLANGES

A. 2" and Smaller Steel: ASTM A197/ANSI B16.3 malleable iron unions with brass seats. Use black malleable iron on black steel piping and galvanized malleable iron on galvanized steel piping.

B. 2" and Smaller Copper: ANSI B16.18 cast bronze union coupling or ANSI B15.24 Class 150 cast bronze flanges.

C. 2-1/2” and Larger Steel: ASTM A181 or A105, Class 150, grade 1 hot forged steel flanges of threaded, welding neck, or slip-on pattern on black steel and threaded only on galvanized steel. ANSI B16.1 or ANSI B16.5, Class 150 cast iron threaded flanges. Use raised face flanges ANSI B16.5 for mating with other raised face flanges or equipment with flat ring or full face gaskets. Use ANSI B16.1 flat face flanges with full face gaskets for mating with other flat face flanges on equipment.

D. 2-1/2” and Larger Copper: ANSI B16.24, Class 150 cast bronze flanges with raised face.

2.03 MECHANICAL GROOVED PIPE CONNECTIONS

A. Manufacturers: Victaulic, Anvil, Star Fittings

B. All mechanical grooved pipe material including gaskets, couplings, fittings and flange adapters to be from the same manufacturer. Mechanical grooved components and assemblies to be rated for minimum 175 psi working pressure unless noted otherwise.

C. Couplings and fittings to be malleable iron, ASTM A47 or ductile iron A536 with painted finish. Fittings used on galvanized steel pipe to have galvanized finish, ASTM A153.

D. Gaskets to be EPDM, ASTM D2000. Gaskets for dry systems to be flush seal design. Heat treated carbon steel oval neck track bolts and nuts, ASTM A-183, with zinc electroplated finish.

E. Flange adapters to be ductile iron, ASTM A536; except at lug type butterfly valves where standard threaded flanges shall be used.

2.04 SPRINKLERS

A. Manufacturers: Grinnell, Reliable, Tyco, Viking, Globe

B. Sprinkler Head Guard: Viking D-1, hard wire cage, 3-1/8” high by 3-1/8” diameter, self-tapping screws. Clear chromate finish over zinc plating, except white finish required on white

finish sprinklers. Head Guard is UL listed or FM approved for use with corresponding sprinkler.

C. Fusible link or glass bulb type, cast brass or bronze construction. Provide sprinklers with minimum nominal 1/2” discharge orifice.

1. Quick Response Pendant: white finish and escutcheon
2. Quick Response Concealed Pendant: White cover plate
3. Quick Response Sidewall: White finish and escutcheon
4. Standard Response Pendant: Brass finish
5. Standard Response Upright: Brass finish
6. Standard Response Dry Horizontal Sidewall: Chrome plated finish and escutcheon

2.05 FLEXIBLE SPRINKLER CONNECTORS

A. Manufacturers: Aqua Flex, Flex Head, Sprinkflex, Victaulic, Viking

B. UL/FM Type 304 stainless steel flexible sprinkler connection, 175 psi rated, braided flexible stainless steel tubing with 1” diameter internal corrugated hose, stainless steel hose nipples, and galvanized steel attachment brackets for use in either suspended or hard ceilings.

2.06 SWITCHES

A. Manufacturers: Potter Electric Signal, System Sensor, Notifier

B. Flow Switches: Vane type waterflow switch with metal enclosure, adjustable pneumatic retard and electrical characteristics compatible with alarm system.

C. Supervisory Switches for O. S. & Y. gate valve installations: UL/FM listed/approved, to monitor position of valve, tamper resistant cover screws, single or double SPDT switch contacts, corrosion resistant, for indoor or outdoor use, NEMA 4 & 6P enclosures.

D. Pressure Switches: Pressure actuated switch with field adjustable settings, metal enclosure and electrical characteristics compatible with alarm system.

2.07 LOCAL ALARM HORN/STROBE

A. Manufacturers: Potter Electric Signal, Gentex, System Sensor, Simplex, Siemens, Wheelock

B. UL listed multi-tone electric horn and strobe for outdoor use, with red finished housing, white lettering, weatherproof backbox, 12/24 VDC, and electrical characteristics compatible with building alarm system. Potter SASH-24.

2.08 PRESSURE GAUGES

A. Manufacturer: Ametek/U. S. Gauge Division, Ashcroft, Marsh, Taylor, H. O. Trerice, Weiss, Weksler.

B. Cast aluminum, stainless steel or brass case of not less than 3-1/2 inches in diameter, glass window, black lettering on a white background, phosphor bronze bourdon tube with bronze bushings, recalibration from the front of the dial, 99% accuracy over the middle half of the scale, 98.5% accuracy over the remainder of the scale. Include bronze 3-way globe valve with plugged outlet for Fire Inspector's test gauge.

2.09 VALVES

A. Manufacturers: Kennedy, Milwaukee, Nibco, Stockham, Viking, Watts

B. Gate Valves

1. 2” and smaller: Outside screw and yoke gate valves, 175 psig, bronze body, bronze mounted, screwed bonnet, rising stem, solid wedge.
2. 2-1/2” and larger: Outside screw and yoke gate valves, 175 psig, cast iron body, bronze mounted, bolted bonnet, rising stem, solid wedge.

C. Butterfly Valves

1. 2” and smaller: Bronze body butterfly valve, 175 psig, geared operator, visible position indicator, normally open tamper switch with double wire leads, Buna or Viton seat, stainless steel disc and stem.
2. 2-1/2” and larger: Cast or ductile iron body butterfly valve, lug style or grooved, 175 psig, geared operator, visible position indicator, normally open supervisory/tamper switch with double wire leads, EPDM resilient seat, EPDM seals, nickel plated ductile iron disc. Valve assembly to be bubble tight to 175 psig with no downstream flange/pipe attached.

D. Check Valves

1. 2” and smaller: Bronze body, threaded end, Y-pattern, regrindable bronze seat, renewable bronze disc, 175 psig, suitable for installation in a horizontal or vertical line with flow upward, with flanged inspection plate.
2. 2-1/2” and larger: Cast or ductile iron body, flanged or grooved ends, bronze trim, bolted cap, renewable bronze seat and disc, 175 psig, suitable for installation in a horizontal or vertical line with flow upward, with flanged inspection plate.
3. Provide 1/2” automatic drip drain on inlet of fire department connection check valve.

E. Drain Valves

1. 3/4” minimum, two piece bronze body ball valve with threaded ends, chrome plated bronze ball, glass filled Teflon seat, Teflon packing and threaded packing nut, blowout-proof stem, 400 psig WOG, and capped hose thread outlet.

2.10 DOUBLE CHECK BACKFLOW PREVENTION ASSEMBLY

A. Manufacturers: Apollo, Febco, Watts, Zurn

B. ASSE 1015 double check valve assembly with 2 independent spring loaded check valves, 2 isolation ball or gate valves with normally open tamper switch with double wire leads, 4 valved test ports. Body constructed of epoxy coated ductile iron or stainless steel with bronze and plastic internal parts, stainless steel springs, silicone rubber valve discs, bronze seats, rated for 175 psig.

2.11 SPECIALTIES

A. Manufacturers: Reliable, Tyco, Victaulic, Viking, Globe

B. Air Pressure Maintenance Device

1. Automatic control capable of maintaining system air pressure, rated for 175 psig, adjustable air pressure range of 15 to 60 psig, complete with isolation valves, bypass fill valve, pressure regulator or pressure switch and strainer.

C. Emergency Pull Box

1. 1/2” ball valve in metal enclosure with 1/2” pipe nipple, "Manual Emergency Station" label and breakaway door.

2.12 DRY VALVES

A. Manufacturers: Reliable, Tyco, Victaulic, Viking, Globe

B. Cast or ductile iron body, flanged or grooved ends, 175 psig, bronze grooved seat with o-ring seal, single hitch pin and latch design. Provide trim for air supply, drain, priming level, alarm connections, pressure gauges, priming chamber attachment, ball drip valves, drip cup assembly piped to floor or hub drain, and fill line attachment with strainer.

2.13 FIRE DEPARTMENT CONNECTION

A. Manufacturer: Croker, Elkhart Brass, Potter-Roemer

B. Flush:

1. Storz fire department inlet connection with hard coated aluminum body, 5” large diameter hose inlet, 4” NPT outlet and cast brass lettered identification plate. Coordinate with

Delavan Fire Department whether a 30 degree turn down should be provided at Storz inlet connection. This will be determined by final installation height of FDC.

2.14 AIR COMPRESSOR

A. Manufacturer: Gast, Quincy, Viking

B. Single zone and small systems: Riser pipe mounted air compressor installation. Electric motor driven, air cooled, oil-less, adjustable, single stage compressor. With check valve, pressure switch, pressure relief valve, mounting bracket kit and air filter assembly. Equal to Viking model E-1.

2.15 DRY NITROGEN SUPPLY SYSTEM

A. Manufacturer: Potter, Engineered Corrosion Solutions, Viking

B. To slow metallic pipe corrosion and extend pipe life in dry pipe systems include on-site nitrogen generator with oxygen purge and nitrogen fill, FM 1035 approved Nitrogen Generator, with automatic control panel. Nitrogen generator shall use membrane technology for gas separation, 98-percent minimum purity dry nitrogen, with or without nitrogen storage tank. System automatically bleeds oxygen and high moisture content air from dry pipe system with purge valve located at the furthest point from the fire sprinkler riser for each fire sprinkler riser, and replaces with high purity dry nitrogen, piped through the air maintenance device. Additional purge valves are to be installed as required by manufacturer requirements. System shall have BAS alarm relay to indicate trouble if nitrogen purity drops below acceptable levels.

PART 3 - EXECUTION

3.01 GENERAL

A. Install pipe and fittings in accordance with reference standards, manufacturer's recommendations and recognized industry practices.

B. Install piping parallel to building walls and ceilings and at heights which do not obstruct any portion of a window, doorway, stairway, or passageway. Where interferences develop in the field, offset or reroute piping as required to clear such interferences. Coordinate locations of fire protection piping with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. In all cases, consult drawings for exact location of pipe spaces, ceiling heights, ceiling grid layout, light fixtures and grilles before installing piping.

C. Where piping is embedded in masonry or concrete, provide protective sleeve covering of elastomeric pipe insulation.

D. Provide 3/32" minimum thickness steel nailing plates behind or on either side of piping where the possibility of penetration from nails or drywall screws exists.

E. Maintain piping in clean condition internally during construction.

F. Provide clearance for access to valves and piping specialties.

G. Install piping so that system can be drained. Where possible, slope to main drain valve. Slope dry pipe and pre-action systems subject to freezing at minimum 1/4" per 10 feet on mains and 1/2" per 10 feet on branches. Where piping not susceptible to freezing cannot be fully drained, install nipple and cap for drainage of less than 5 gallons or ball valve with hose thread outlet and cap for drainage over 5 gallons. Pipe main drain valve to grade or to air gap sewer receptor.

H. Mitered ells, notched tees, strap tees, and orange peel reducers are not acceptable. On threaded piping, bushings are not acceptable.

I. Do not route piping within exterior walls.

J. Do not route piping through transformer vaults or above transformers, panelboards or switchboards, including the required service space for this equipment, unless the piping is serving this equipment.

K. Install all valves and piping specialties, including items furnished by others, as specified and/or detailed. Provide access to valves and specialties for maintenance. Make connections to all equipment, fixtures and systems installed by others where same requires the piping services indicated in this section.

L. Sprinkler takeoffs from branch lines are to be made from top quadrant of branch line.

3.02 COPPER PIPE JOINTS

A. Remove all slivers and burrs remaining from the cutting operation by reaming and filing both pipe surfaces. Clean fitting and tube with metal brush, emery cloth or sandpaper. Remove residue from the cleaning operation and assemble joint to socket stop. Apply flame to fitting until brazing alloy melts when placed at joint. Wipe excess alloy from joint.

3.03 WELDED PIPE JOINTS

A. Make all welded joints by fusion welding in accordance with ASME Codes, ANSI B31, and State Codes where applicable. "Weldolets" and "Threadolets" may be used only for connections up to one-half (1/2) the diameter of the immediate upstream piping.

3.04 THREADED PIPE JOINTS

A. Use a thread lubricant or Teflon tape when making joints; no hard setting pipe thread cement or caulking will be allowed.

3.05 MECHANICAL GROOVED PIPE CONNECTIONS

A. Use pipe factory grooved in accordance with the coupling manufacturer's specifications or field grooved pipe in accordance with the same specifications using specially designed tools available for the application. Lubricate pipe and coupling gasket, align pipe, and secure joint in accordance with the coupling manufacturer's specifications.

3.06 MECHANICALLY FORMED TEE FITTINGS

A. Form mechanically extracted collars in a continuous operation, consisting of drilling a pilot hole and drawing out the tube surface to form a collar having a height of not less than three times the thickness of the tube wall. Use an adjustable collaring device. Notch and dimple the branch tube. Braze the joint with neutral flame oxy-acetylene torch, applying heat properly so that pipe and tee do not distort; remove distorted connections.

3.07 UNIONS AND FLANGES

A. Install a union, flange or grooved coupling combination at each connection to each piece of equipment and at other items which may require removal for maintenance, repair, or replacement. Where a valve is located at a piece of equipment, locate the flange or union or grooved coupling combination connections on the equipment side of the valve. Concealed unions, flanges or couplings are not acceptable.

3.08 INSTALLATION OF FIRE SUPPRESSION SYSTEM COMPONENTS

A. Install fire suppression system components in accordance with NFPA, product listings and manufacturer’s recommendations. Locate where accessible for servicing and replacement.

B. Sprinkler Heads: Locate sprinklers as indicated on fire protection drawings and reflected ceiling plan maintaining minimum clearances from obstructions, ceilings and walls. Install sprinklers level in locations not subject to spray pattern interference. Provide sprinkler installations below ductwork, soffits, etc.

C. Select sprinkler temperature rating to not exceed maximum ambient temperature rating allowed under normal conditions at installed location. Provide ordinary temperature (nominally 165°F.) sprinkler except at skylights, adjacent to diffusers, unit heaters, un-insulated heating pipes or ducts, within electrical rooms, elevator equipment rooms, top of elevator hoistways, mechanical rooms, storage rooms, or where otherwise indicated.

D. Exposure Protection: Specific application window sprinklers shall be used to protect non-operable window openings that are in a fire separation. Install sprinklers on both sides of the window in the fire separation.

E. Spare Sprinklers: Provide quantity of spare sprinklers as noted below and 1 wrench for each type and temperature range installed. Provide 6 spares per 300 or less installed sprinklers, 12 per 1000 or less and 24 for more than 1000. Provide steel cabinet for storage of sprinklers and wrenches.

F. Pipe riser main drains, test connections and auxiliary drains, where required, to building exterior or as indicated on drawings. Discharge to plumbing fixtures, including mop basins, is not allowed.

G. Gauges: Provide a valved pressure gauge in main system riser at inlet and outlet of pump and elsewhere as indicated.

H. Valves: Properly align piping before installation of valves. Do not support weight of piping system on valve ends. Mount valves in locations which allow access for operation, servicing and replacement. Install all valves with the stem in the upright or horizontal position. Valves installed with the stems down will not be accepted. Provide capped hose thread drain valves to allow draining of each trapped portion of piping.

I. Dry Valves: Install in vertical position in system riser. Install trim recommended by manufacturer including drain and test valves. Pipe drains to hub or floor drains. Test and adjust operation of valves, alarms, pressure maintenance devices, emergency pull boxes and deluge/pre-action controls.

J. Fire Department Connections: Mount on wall where indicated. Support from structure independent of piping. Locate between 3' to 4' above grade. Fill wall penetration with insulation and caulk exterior and interior face of wall opening weathertight.

K. Air Compressor: Attached to system riser or install on concrete housekeeping pad, leveled and bolted in place. Pipe automatic drain discharge piping to floor drain. Install line size ball valve and check valve in discharge line. Install pressure gauge upstream of ball valve.

L. Dry Nitrogen Supply: Install in a clean, dry and well ventilated area, with ambient temperature above 50 deg F at all times. Rapid release of nitrogen in an enclosed space can cause an asphyxiation hazard. Comply with manufacturer detailed installation instructions.

3.09 PIPING SYSTEM LEAK TESTS

A. Conduct pressure test with test medium of water. If leaks are found, repair the area with new materials and repeat the test. Caulking will not be acceptable.

B. Test piping in sections or entire system as required by sequence of construction. Do not conceal pipe until it has been successfully tested. If required for the additional pressure load under test, provide temporary restraints at fittings or expansion joints. Entire test must be witnessed by the owner's project representative.

C. Use clean water and remove air from the piping being tested where possible. Measure and record test pressure at the high point in the system.

D. Test system at 200 psi for 2 hours showing no leakage. Where system design is in excess of 150 psig, test at a pressure 50 psig above system design pressure.

E. Modifications to existing systems affecting 20 or fewer sprinklers shall not require testing in excess of system working pressure.

F. All pressure tests are to be documented on NFPA contractor's material and test certificate forms.

END OF SECTION

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SECTION 26 05 00
COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Electrical Contractor provide: It is the intent of these specifications to provide complete and workable electrical systems as shown on the accompanying plans and as specified herein except such parts as are specifically exempted herein. Provide all necessary supervision, coordination, labor, materials, equipment, fixtures, drayage, hoisting, tools, transportation, plant services and facilities, machinery and connections to utilities for the installation of complete and operable electrical systems. If details or special conditions are required in addition to those shown on drawings, provide all material and equipment usually furnished with such systems or required to complete their installation, whether noted in plans and specification or not.

B. Materials and labor shall be new (unless noted otherwise), first class and workmanlike and shall be subject at all times to the A/E's inspections, tests and approval from the commencement until the acceptance of the completed work.

C. The layout shown on the drawings is necessarily diagrammatic but shall be followed as closely as other work will permit. The drawings provide design intent. The Contractor shall verify all dimensions at the site and be responsible for their accuracy.

D. All sizes as given are minimum except as noted.

E. Because of the scale of the Drawings, certain basic items, such as, pipe fittings, duct fittings, access panels, and sleeves, may not be shown. Where such items are required by Code or by other Sections, or where required for proper installation of the Work, such items shall be included, whether shown or not.

F. In the event of any inconsistencies between the specifications, drawings, contract documents, applicable laws, statutes, ordinances, building codes, rules and regulations, the contractor shall provide the better quality or greater quantity of work and comply with or conform its work to the most stringent legal or contractual requirements.

G. Changes from these drawings required to make this work conform to the building construction shall be made only with prior written approval of the Architect/Engineer. All proposed changes shall be shown on shop drawings. All measurements shall be verified by actual observation and all work shall fit in place meeting the approval of the Architect/Engineer.

H. Equipment Specification may not deal individually with minute items required, such as, components, parts, controls, and devices which may be required to produce the equipment performance specified or as required to meet the equipment warranties. Where such items are required to make the system operational, they shall be included by the supplier of the equipment at no additional cost, whether or not specifically called for.

1.02 SECTION INCLUDES

A. The work under this section includes basic electrical requirements, which are applicable to all Division 26 sections. This section includes information common to two or more technical specification sections or items that are of a general nature, not conveniently fitting into other technical sections.
   1. Submittals
   2. Reference Standards
   3. Quality Assurance
   4. Guarantee
   5. Work by Owner
   6. Provisions for Future
   7. Operation and Maintenance Instructions
   8. Record Documents
   9. Protection of Finished Surfaces
   10. Sealing and Firestopping
   11. Off Site Storage
   12. Regulatory Requirements

13. Certificates and Inspections
14. Coordination
15. Temporary Electrical Work
16. Approved Electrical Testing Laboratories
17. Sleeves and Openings
18. Omissions
19. Definitions
20. Project/Site Conditions
21. Work Sequence and Scheduling
22. Work by Other Trades
23. Training
24. Access Panels and Doors
25. Identification
26. Excavation and Backfill
27. Concrete Work
28. Lintels
29. Building Access
30. Equipment Access
31. Housekeeping and Clean Up

1.03 RELATED WORK

A. Applicable provisions of Division 1 govern work under this section.
B. The electrical work included in all other divisions is the responsibility of the contractor performing the Division 26 work unless noted otherwise.
C. Section 01 91 13 – Commissioning Requirements
D. Division 21 – Fire Suppression
E. Division 22 – Plumbing
F. Division 23 – Heating, Ventilating and Air Conditioning
G. Division 27 – Communications
H. Division 28 – Electronic Safety and Security

1.04 SUBMITTALS

A. Submit shop drawings for equipment under each section per requirements listed in that section, as well as per Division 1.
B. Submit for all equipment and systems as indicated in the respective specification sections, marking each submittal with that specification section number. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in the contract documents. Failure to do this may result in the submittal(s) being returned to the Contractor for correction and resubmission. Do not submit hard copies of web pages. Failing to follow these instructions does not relieve the Contractor from the requirement of meeting the project schedule.
C. On request from the A/E, the successful bidder shall furnish additional drawings, illustrations, catalog data, performance characteristics, etc.
D. Submittals shall be grouped to include complete submittals of related systems, products, and accessories in a single submittal. Mark dimensions and values in units to match those specified. Include wiring diagrams of electrically powered equipment.
E. The submittals must be approved before fabrication is authorized.
F. Provide electronic copies of all submittals for review.

1.05 REFERENCE STANDARDS

A. Abbreviations of standards organizations referenced in this and other sections are as follows:
   1. ANSI American National Standards Institute
   2. ASTM American Society for Testing and Materials
   3. EPA Environmental Protection Agency
   4. ETL Electrical Testing Laboratories, Inc.
   5. IEEE Institute of Electrical and Electronics Engineers

6. IES Illuminating Engineering Society
7. ISA Instrument Society of America
8. NBS National Bureau of Standards
9. NEC National Electric Code
10. NEMA National Electrical Manufacturers Association
11. NESC National Electrical Safety Code
12. NFPA National Fire Protection Association
13. UL Underwriters Laboratories Inc.

1.06 QUALITY ASSURANCE

A. Substitution of Materials: Refer to Division 1 for equals and substitutions.
   1. Where the following conflicts with Division 1, the requirements of Division 1 shall govern.
   2. If the Contractor wishes to submit an alternate to the named manufacturers for any equipment, he may submit a voluntary alternative minimum 7 days prior to bid, stating the manufacturer's name, model number, written, detailed product data.
   3. Where materials or equipment are specified by name the proposed material or equipment must be identical to the specified material or equipment in all characteristics of quality, function and serviceability, regardless of application in the Project and, in addition, when the Architect deems that aesthetic significance is important, the equal material or equipment must be identical in all characteristics of visual appearance, design, color and texture. Any proposed equal shall be submitted to Architect/Engineer for prior approval, which Architect/Engineer may approve or disapprove in its sole discretion. Work performed or constructed with unapproved equals is at Contractor's risk and any required correction of work incorporating unapproved equals shall be at Contractor's sole cost and expense.
   4. In all instances, Contractor shall assume full responsibility for proof of equality of the statute to the equipment hereinafter specified. All data and information necessary for proof of equality, function and space requirements shall be prepared and accompany the submittal of the substitution to the Architect/Engineer. Approval by the Architect/Engineer of equipment other than the specified does NOT relieve Contractor of this responsibility.
B. All products and materials used are to be new, undamaged, clean and in good condition. Existing products and materials are not to be reused unless specifically indicated.
C. Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings, or engineering parameters from those indicated on the contract documents, the contractor is responsible for all costs involved in integrating the equipment or accessories into the system, including, but not limited to, coordination with other trades and any required changes by other trades and for obtaining the intended performance from the system into which these items are placed.
D. All materials, except medium voltage equipment and components, shall be listed by and shall bear the label of an approved electrical testing laboratory. If none of the approved electrical testing laboratories has published standards for a particular item, then other national independent testing standards, if available, applicable, and approved by A/E, shall apply and such items shall bear those labels. Where one of the approved electrical testing laboratories has an applicable system listing and label, the entire system, except for medium voltage equipment and components, shall be so labeled.

1.07 GUARANTEE

A. Refer to Division 1 for Guarantees and Warranties. In addition to the requirements in Division 1, this Contractor shall meet the following requirements.
B. In entering into a contract covering this work, the contractor accepts the specifications and guarantees that the work will be carried out in accordance with the requirements of this specification or such modifications as may be made under the contract documents.
C. Contractor further guarantees that the workmanship and material will be of the best procurable and that none but experienced workmen familiar with each particular class of work will be employed.
D. Contractor further guarantees to replace and make good at his own expense, including travel time, all defects, which may develop within 1 year after final payment and acceptance by the Architect/Engineer, due to faulty workmanship or material, upon, receipt of written notification from the Owner.

1.08 WORK BY OWNER

A. Electrical testing not described in these contract documents will be by the Owner under separate contract.

1.09 PROVISIONS FOR FUTURE

A. Site Monument Sign. Refer to site plan for work required as part of this project
B. Roof Mounted Photovoltaic System. Refer to one-line diagram for breaker provisions as part of this project.

1.10 OPERATION AND MAINTENANCE INSTRUCTIONS

A. Refer to Division 1 for all operations and maintenance instructions.
B. In addition to the general content specified under Division 1 supply the following additional documentation:
   1. Manufacturer's wiring diagrams for electrically powered equipment.
   2. Copies of all approved submittals along with approval letters.

1.11 RECORD DOCUMENTS

A. Refer to Division 1 for record documents.
B. In addition to the general content specified under Division, follow the following procedures.
   1. During the progress of the work, Contractor shall maintain a current (daily) record set of the drawings and specifications, indicating thereon all work installed at variance with such Contract Documents including, without limitation, work covered by Addenda, Field Work Orders, Change Orders and Engineers additional instructions, interpretations and clarification. All changes or deviations from the original layout of the work and all critical dimensions of buried or concealed work shall be recorded. It shall be Contractor's responsibility to assure that said record sets are complete, accurate and up-to-date, Engineer shall have the right to inspect and review such record sets.
   2. At the completion of the work, Contractor shall indicate on record sets all record changes and such additional details necessary or appropriate to provide a complete reference document for use by Engineer. If variations and details cannot be shown clearly thereon, the Contractor shall prepare supplemental drawings adequate to impart the information. The foregoing drawings collectively shall constitute the "Record" drawings for the work.
   3. All indication on "Record" drawings shall be executed in a legible manner at Contractor's cost, using methods and legend presentations compatible with the overall scheme of the record drawings with respect to scale, drawing sheet sizes and sequential indexing. All changes shall be marked clearly in red and clouded.
   4. Engineer may review Contractor's "Record" drawings and notify Contractor of observed discrepancies or deviations. Contractor shall promptly correct discrepancies, deviations or illegible markups at Contractor's expense and resubmit revised drawings for Engineer review.
   5. Contractor shall provide final electronic record drawings to the Owner through the Engineer.
   6. Engineer will provide final electronic record drawings to the Owner based on Contractor's markups.

1.12 PROTECTION OF FINISHED SURFACES

A. Refer to Division 1 for protection of finished services.
B. Furnish one can of touch-up paint for each different color factory finish furnished by the Contractor. Deliver touch-up paint with other "loose and detachable parts" per Division 1.

1.13 SEALING AND FIRESTOPPING

A. Sealing and firestopping of sleeves/openings between conduits, cable trays, wireways, troughs, cablebus, busduct, etc. and the structural or partition opening shall be the responsibility of the contractor whose work penetrates the opening. The contractor responsible shall hire individuals skilled in such work to do the sealing and firestopping. These individuals hired shall normally and routinely be employed in the sealing and fireproofing occupation.
B. Contractor shall request current life safety drawings from the Architect/Owner.

1.14 OFFSITE STORAGE

A. If payment will be requested for approved offsite stored material, then the Contractor shall complete an "Off-site Storage Agreement" which is available from the Owner. Prior approval by Owner's personnel for offsite storage will be needed. No material will be accepted for offsite storage unless submittals for the material have been approved.

1.15 REGULATORY REQUIREMENTS

A. All work and materials are to conform in every detail to applicable rules and requirements of the Wisconsin State Electrical Code Volumes 1 and 2, the National Electrical Code (ANSI/NFPA 70), other applicable National Fire Protection Association codes, the National Electrical Safety Code, present manufacturing standards (including NEMA) and the Authority Having Jurisdiction (AHJ).

B. All Division 26 work shall be done under the direction of a currently certified State of Wisconsin Certified Master Electrician.

1.16 CERTIFICATES AND INSPECTIONS

A. Refer to Division 1 for permits, regulations, utilities and taxes.

B. Obtain and pay for all required State or local installation inspections except those provided by the Architect/Engineer in accordance with State Code. Deliver originals of these certificates to the Owner. Include copies of the certificates in the Operating and Maintenance Instructions.

C. Coordinate and provide inspections as required by the Authority Having Jurisdiction over the site.

D. This contractor is responsible for coordination of Owner's electrical inspection. Inspection requirements will be issued at a pre-installation meeting, arranged by this contractor and the Owner's Electrical Inspector (See Article 15 of the General Conditions).

1.17 COORDINATION

A. Refer to Division 1 for coordination. In addition to the requirements specified under Division 1, the following requirements apply.

B. It shall be the responsibility of each Contractor to coordinate and consult with each other to determine space requirements and to determine that adequate space for servicing is provided for all equipment whether furnished by the Contractor or others. The General Contractor shall have final decision on all space priority conflicts among Contractors. All space priority conflicts shall be brought to the attention of the Architect/Engineer and Owner's Representative.

C. Each Contractor shall thoroughly familiarize himself with existing systems which will affect and be affected by relocation of existing equipment and installation of new lines and equipment. They shall plan installation of their work so that interruptions of services to any building or portion thereof will be a minimum, and such interruptions shall occur only when system is not required, if possible. If not possible, each Contractor shall insure the operation of services by whatever means possible, such as, installing bypasses, or providing temporary service or circuits. Each interruption shall be for as short a duration as possible.

D. Cooperation among all Contractors shall be required. Any Work that is installed without cooperating or coordinating with other Contractors and is in conflict shall be removed and reinstalled at that particular Contractor's cost. No cost additions to the Project will be considered due to a Contractor's lack of participation in the cooperation and coordination process. The following list of items of Work shall be the priority of order for all Contractors:
   1. Structure
   2. Recessed light fixtures
   3. Gravity-flow systems for sanitary, storm, steam and steam condensate piping
   4. Ductwork and appurtenances
   5. Electrical primary and secondary feeder conduits and low voltage cable tray
   6. Plumbing vent piping
   7. Fire protection (sprinkler system)
   8. HVAC piping
   9. Gas piping, process piping and domestic water
   10. Electrical branch circuit conduit and low voltage conduit
   11. Control conduit

E. The above list, in descending order, is the precedence assigned the Work items for space priority. Gravity-flow systems have first priority.
F. Exception: Plumbing lines below or behind plumbing fixtures shall have precedence over all other work. Electrical conduit above or below switchgear, panelboards and control panels shall have precedence over all other work. Do not install any fluid conveying piping over electrical or elevator equipment.
G. In the case of interconnection of the work of two or more contractors, verify at the site or on shop drawings all dimensions relating to such work. All errors due to the failure to so verify any such dimensions shall be promptly rectified.
H. Any installed work that is not coordinated and interferes with another contractor's work shall be removed or relocated at the installing contractor's expense.
I. Prior to start of Construction, the General Contractor shall schedule a meeting with all of the Contractors responsible for the work items listed above. The purpose of the meeting is to introduce the coordination program and to determine its implementation in relation to the progress schedule.
J. At the initial Coordination Meeting, the Mechanical Contractor / Ventilating Contractor shall provide to the General Contractor outline drawings at 1/4" scale indicating column centerlines, interior partition locations, and ceiling heights. The General Contractor shall verify all information shown on these drawings and relay any changes in the information to the Ventilation Contractor to be reflected on the Drawings. The Ventilating Contractor, with reference and consideration to the Structural, Heating, Electrical, Fire Protection, and Plumbing Drawings, shall draw to scale his proposed installation showing duct sizes, equipment layouts, and dimensions from column lines and from finished floors to bottom of ducts. Ductwork shall be maintained as tightly as possible to the underside of floor slabs and/or beams. For congested areas the Ventilating Contractor shall, in addition, prepare Drawings in section view. During this phase of the program, it shall be the Electrical Contractor's responsibility to furnish the Ventilating Contractor with recessed lighting installation and clearance requirements. This information shall be outlined on the Drawings by the Ventilating Contractor.
K. The ductwork layouts shall be produced in sequence as mandated by the Project Schedule. The earliest area indicated in the Schedule shall receive the first effort, etc.
L. When the Ductwork Drawings for the earliest scheduled area have been completed (time limitation as determined at the initial coordination meeting), the Ventilating Contractor shall provide the General Contractor with one set of drawings for each participant in the effort. The General Contractor will distribute the drawings to the participating Contractors for their use in drawing thereon the major components of their proposed installation using the general scheme shown on the Contract Drawings as a guide.
M. The major components to be indicated include (but are not limited to) the following:
    1. Structure
    2. Roof drain leaders
    3. Above 3" waste piping
    4. Sprinkler mains
    5. Heating hot water mains
    6. Significant primary and secondary feeder conduit runs
    7. Cable trays
    8. Contract ceiling heights
    9. Soffits
    10. Access points
    11. Fire wall penetrations
    12. Steam and condensate mains
    13. Gas, water, and process piping
N. Information delineated shall be distance from column centerlines, pipe/equipment size, and distance from finished floor to bottom of pipe/equipment and hangers. Included on the Drawings shall be piping layout with hanger locations and hanger point loads. This information shall be developed satisfactorily enough to allow the Structural Engineer to verify the adequacy of the structural system for the projected loads. The hanger locations may have to be moved depending on the structural system review. No hanger shall be fabricated and/or installed until the hanger locations are reviewed and accepted by the Architect/Engineer.

O. Within a period not to exceed two weeks after distribution of the drawings, the General Contractor will schedule a meeting with the Architect/Engineer and participating Contractors at which time areas of conflict shall be resolved. The drawings shall be overlaid to identify areas of conflict. All parties shall then cooperate in resolving the conflicts. Records of the agreements shall be entered on the Ventilating Contractor's drawings, acknowledged by all participants by signature in space provided for this purpose, and two copies distributed to all involved parties. All coordination drawing preparation and reproduction costs shall be borne by the Ventilating Contractor. The above drawings, review, and coordination process shall be repeated until all areas on the Project have been coordinated.

P. In the event a Contractor fails to cooperate in the Coordination Program, they shall be held responsible for all costs incurred for adjustments to the work of others made necessary to accommodate the uncooperative Contractor's installations.

1.18 TEMPORARY ELECTRICAL WORK

A. The Electrical Contractor shall make all arrangements with the local utility company for metered electrical service, pay for the installation of all temporary service to utility point of termination shown on drawings, and upon completion of project, pay for removal of temporary service. The Electrical Contractor shall patch surfaces and structure after services have been removed. The service shall be 120/208 volt, 3 phase, 4 wire, 200 amps .

B. If a Contractor contemplates the use of equipment that requires a different voltage or greater capacity than that specified, then that Contractor must arrange with Utility for this additional service and pay for installation of the service and the necessary additional switches and wiring required.

C. The meter shall be taken out in the General Contractor's name.

D. The General Contractor shall pay for all electrical energy consumed for construction purposes for all trades including temporary offices, for operation of ventilating equipment, for heating of building, and for testing and operating of all equipment. The General Contractor shall continue to pay for energy used until substantial completion even though equipment has been connected to the permanent wiring.

E. Any Trade that has a temporary office shall provide and pay for installation of temporary service for lighting of such temporary office.

F. The Electrical Contractor shall provide meter base and wiring to point of utility termination, provide 3R main fused service switch, and 3R fused or 3R breaker distribution panel(s) or power centers. The Electrical Contractor shall also provide, at no cost to others, all lamps, wiring, switches, sockets and similar equipment required for temporary system until substantial completion. Upon completion of the project, the Electrical Contractor shall remove the temporary system.

G. The temporary lighting system shall be sufficient to enable all trades to safely complete their work and to enable Owner's Project Representative to check all work as it is being done. Illumination shall be 5 foot-candles minimum in all areas and, in addition, shall meet or exceed the requirements of 29 CFR 1926.56 Illumination (OSHA regulations).

H. Provide at least four duplex outlets for small power tools for each 400 square feet of floor space, 120 volt single phase. Locate duplex outlets so that the power is available at any point of use with not more than 100 ft. power cord. Circuits shall be 20 ampere, single pole.

I. In accordance with the latest issue of the National Electrical Code, all temporary electrical circuits for construction purposes shall be equipped with combination ground fault interrupter and circuit breakers meeting the requirements of UL for Class A, Group 1 devices. The ground fault interrupter portion shall be solid state type, insulated and isolated from the breaker mechanism. A test button shall be provided for checking the device. The breaker mechanism shall provide overload and short circuit protection and shall be operated by a toggle switch with overcenter switching mechanism so that contact cannot be held closed.

J. All Trades shall furnish their extension cords and lamps other than those furnished for general lighting.

K. All Trades and other separate Contractors shall be allowed to use the service provided for general lighting and fractional horsepower hand tools at no cost.

L. Those trades requiring lighting or other electrical service outside of building shall pay for the installation and removal of service, maintenance charges, and energy consumed.

M. Trades requiring voltage other than basic temporary system specified, three phase power, or a special single phase run, for operation of construction equipment or testing shall make their own arrangements with the Electrical Contractor for the cost of installation, and removal when no longer required.

N. Heating and Ventilating Trade shall provide wiring, equipment and connections for portable or temporary heating units.
O. The Electrical Contractor shall expedite the work under this contract in such a manner that the permanent power wiring system and panels will be installed and connected to permanent heating and ventilating equipment in time to operate and test this equipment when the building has been closed sufficiently to permit the use of portions of heating and ventilating system for temporary heating during construction. Permanent wiring and connections may be used at permanent equipment; however, the use of the permanent system during construction shall in no way waive any part of the guarantee period.
P. After Substantial Completion of the permanent electrical system and building wiring, permanent receptacles may be used during finishing work. Permanent wiring for lighting fixtures, switches and receptacles shall be installed only after all masonry and plastering has been completed, but this wiring shall not be used for motors larger than fractional HP or for welding equipment. Circuits for larger motors and welding equipment may be provided with special circuits to mains of electrical panels at the expense of those trades requiring them, provided that special permission is obtained from Owner's Project Representative and the installation is made by skilled electricians.

1.19 APPROVED ELECTRICAL TESTING LABORATORIES

A. The following laboratories are approved for providing electrical product safety testing and listing services as required in these specifications:
   1. Underwriters Laboratories Inc.
   2. Electrical Testing Laboratories, Inc.

1.20 SLEEVES AND OPENINGS

A. Openings required in new or existing construction that may be necessary for the installation of new work shall be provided by the respective contractor and all patching and repairing shall be done by workmen competent in the trade required, at the expense of the respective contractor. The respective contractor shall be responsible for arranging the work so that minimum cutting will be required. All rubbish and excess materials involved in such cutting shall be promptly removed from the site and disposed of by the contractor. Cutting through the floor or roof systems or load bearing walls shall be done only with the prior written approval of the Architect/Engineer so as to avoid damaging the structural system.

1.21 OMISSIONS

A. No later than ten (10) days before bid opening, the Contractor shall call the attention of the A/E to any materials or apparatus the Contractor believes to be inadequate and to any necessary items of work omitted.

1.22 DEFINITIONS

A. Wherever the words “the Contractor”, “this Contractor” or “Electrical Contractor”, appear in this section, they refer to the Contractor for Electrical Work.
B. The term “provide” includes such labor, methods, materials, equipment and transportation or other facilities required to complete the Contract and the performance of all duties thereby upon the Contractor.

1.23 PROJECT/SITE CONDITIONS

A. Install Work in locations shown on Drawings, unless prevented by Project conditions.
B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of A/E before proceeding.
C. Tools, materials and equipment shall be confined to areas designated by the Owner’s project representative.

1.24 WORK SEQUENCE AND SCHEDULING

A. Install work in phases to accommodate Owner's occupancy requirements. During the construction period coordinate schedule and operations with Owner's Construction Representatives.

1.25 WORK BY OTHER TRADES

A. Every attempt has been made to indicate in this trade's specifications and drawings all work required of this Contractor. However, there may be additional specific paragraphs in other trade specifications and addenda, and additional notes on drawings for other trades which pertain to this Trade's work, and thus those additional requirements are hereby made a part of these specifications and drawings.

B. Electrical details on drawings for equipment to be provided by others are based on preliminary design data only. This Contractor shall lay out the electrical work and shall be responsible for its correctness to match equipment actually provided by others.

1.26 TRAINING

A. The contractor shall have the following responsibilities:

B. Provide a training plan sixty days before the planned training covering the following elements:
   1. Equipment
   2. Intended audience
   3. Location of training
   4. Objectives
   5. Subjects covered (description, duration of discussion, special methods, etc.)
   6. Duration of training on each subject
   7. Instructor for each subject
   8. Methods (classroom lecture, manufacturer's quality video, site walk-through, actual operational demonstrations, written handouts, etc.).

C. Provide designated owner personnel with comprehensive orientation and training in the understanding of the systems and the operation and maintenance of each piece of equipment that makes up the system.

D. Training shall normally start with classroom sessions followed by hands-on demonstration/training on each piece of equipment.

E. During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system shall be repaired or adjusted as necessary and the demonstration repeated at another scheduled time, if necessary.

F. The appropriate trade or manufacturer's representative shall provide the instructions on each major piece of equipment. Practical building operating expertise as well as in-depth knowledge of all modes of operation of the specific piece of equipment are required. More than one party may be required to execute the training.

G. The controls contractor shall attend sessions other than the controls training, as specified, to discuss the interaction of the controls system as it relates to the equipment being discussed.

H. The training sessions shall follow the outline in the table of contents of the operation and maintenance manual and illustrate whenever possible the use of the O&M manuals for reference.

I. Training shall include:
   1. Use of the printed installation, operation and maintenance instruction material included in the O&M manuals.
   2. A review of the written O&M instructions emphasizing safe and proper operating requirements, preventative maintenance, special tools needed and spare parts inventory suggestions. The training shall include startup, operation in all modes possible, shutdown, seasonal changeover and any emergency procedures.
   3. Discussion of relevant health and safety issues and concerns.
   4. Discussion of warranties and guarantees.
   5. Common troubleshooting problems and solutions.
   6. Explanatory information included in the O&M manuals.
   7. Discussion of any peculiarities of equipment installation or operation.
   8. Classroom sessions shall include the use of overhead projections, slides, video/audio-taped material as might be appropriate.
   9. Hands-on training shall include startup, operation in all modes possible, including manual, shut-down, alarms, power failure and any emergency procedures, and preventative maintenance for all pieces of equipment.

J. The contractor shall fully explain and demonstrate the operation, function and overrides of any local packaged controls not controlled by the central control system.

K. Video recording of the training sessions will be provided by the contractor and added to the O&M manuals. In addition, factory training videos identifying key troubleshooting, repair, service and/or replacement techniques shall be provided and reviewed with the owner.
L. Provide a minimum of 16 hours of instruction.
M. Provide additional training as specified in other specification sections for specific equipment.

PART 2 - PRODUCTS

2.01 ACCESS PANELS AND DOORS

A. Lay-in Ceilings:
   1. Removable lay-in ceiling tiles in 2 x 2 foot or 2 x 4 foot configuration provided under Division 9 are sufficient; no additional access provisions are required unless specifically indicated.
B. Concealed Spline Ceilings:
   1. Removable sections of ceiling tile held in position with metal slats or tabs compatible with the ceiling system used will be provided under Division 9.
C. Metal Pan Ceilings:
   1. Removable sections of ceiling tile held in position by pressure fit will be provided under Division 9.
D. Plaster Walls and Ceilings:
   1. 16 gauge frame with not less than a 20 gauge hinged door panel, prime coated steel for general applications, stainless steel for use in toilets, showers and similar wet areas, concealed hinges, screwdriver operated cam latch for general application, key lock for use in public areas, UL listed for use in fire rated partitions if required by the application. Use the largest size access opening possible, consistent with the space and the equipment needing service; minimum size is 12" by 12".

2.02 IDENTIFICATION

A. Refer to Electrical Section 26 05 53 – Identification for Electrical Systems.

2.03 SLEEVES AND OPENINGS

A. General:
   1. Pipe sleeves shall be constructed of standard weight ASTM A53 or ASME B36.10 steel with an anchor plate constructed of A36/A36M steel welded to the pipe. The sleeve shall be sized a minimum of 1” larger than piping insulation diameter. The entire assembly shall be hot-dip galvanized after fabrication.
   2. Duct sleeves and piping sleeves passing through interior walls shall be constructed of 24 gauge galvanized steel minimum thickness.
B. Sleeves Through Below Grade Walls:
   1. Provide steel pipe sleeve, ASTM A53, pressure sealing with membrane clamp ring, gasket, water stop ring, external rings, and nitrile rubber link seals. The assembly shall be hot-dip galvanized after fabrication.
      a. Seals: Modular mechanical type seals, consisting of interlocking nitrile rubber links shaped to continuously fill the annular space between the pipe and the sleeve and electrically isolate the carrier pipe from the steel sleeve.
      b. Sealing Element: Polychloroprene rubber material compounded to resist aging, ozone, sunlight, hydrocarbon gases, water, and chemical action.
      c. Hardware: Type 300 series stainless steel fasteners. Threads rolled to produce smooth uniform threads and unbroken flow lines.
      d. Compression Plates: Fiberglass-reinforced polyester plastic, injection molded for high physical properties, dielectric strength and non-cold flow creep characteristics, having high resistance to acidic and alkaline soils.
   2. For sleeves located 15 feet or more below grade provide cast iron sleeve ASTM A74 with compression seals.

2.04 SEALING AND FIRESTOPPING

A. Fire and/or Smoke Rated Penetrations:
   1. Manufacturers:
      a. 3M, STI/SpecSeal, Tremco, Hilti
      b. All firestopping systems shall be by the same manufacturer.
   2. Submittals:
      a. Contractor shall submit product data for each firestop system. Submittals shall include product characteristics, performance and limitation criteria, test data, MSDS sheets, installation details and procedures for each method of installation applicable to this project. For non-standard conditions where no UL tested system exists, submit manufacturer's drawings for UL system with known performance for which an engineering judgment can be based upon.
   3. Product:
      a. Firestop systems shall be UL listed or tested by an independent testing laboratory approved by the Owner and the Authority Having Jurisdiction (AHJ).
      b. Use a product that has a rating not less than the rating of the wall or floor being penetrated. Reference architectural drawings for identification of fire and/or smoke rated walls and floors.
      c. Contractor shall use firestop putty, caulk sealant, intumescent wrapstrips, intumescent firestop collars, firestop mortar or a combination of these products to provide a UL listed system for each application required for this project. Provide mineral wool backing where specified in manufacturer's application detail.
      d. All sealants shall meet the intent of LEED® VOC requirements, <250 g/L VOC contents (less H_20 and exempt solvents).

B. Non-Rated Penetrations:
   1. Conduit Penetrations Through Below Grade Walls:
      a. In exterior wall openings below grade, use a modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the uninsulated conduit and the cored opening or a water-stop type wall sleeve.
   2. Conduit and Cable Tray Penetrations:
      a. At conduit and cable tray penetrations of non-rated interior partitions, floors and exterior walls above grade, use urethane caulk in annular space between conduit and sleeve, or the core drilled opening.

PART 3 – EXECUTION

3.01 EXCAVATION AND BACKFILL

A. Perform all excavation and backfill work to accomplish indicated mechanical systems installation in accordance with Division 31. Blasting will not be allowed without written permission of the Architect/Engineer and the owner.
B. Install lines passing under foundations with minimum of 1-1/2 inch clearance to concrete and insure there is no disturbance of bearing soil.

3.02 CONCRETE WORK

A. Coordinate the quantity and location of all cast-in-place concrete work with the architectural drawings. It is desired that the Electrical Contractor perform no concrete work.
B. The Division 3 Contractor will perform all cast-in-place concrete unless noted otherwise elsewhere. Provide all layout drawings, anchor bolts, metal shapes, and/or templates required to be cast into concrete or used to form concrete for the support of electrical equipment.
C. Required concrete and reinforcing steel shall be as specified in Section 03 30 00. Use only approved equipment shop drawings for dimensions.
D. Concrete equipment pads shall extend 3” beyond equipment in each direction. Chamfer top edges ½”. Trowel all surfaces smooth.

E. Concrete equipment pads: Provide 3-½" minimum thickness reinforced concrete bases under equipment installed on building floors. Rough up building floor to assure bonding of base to floor. Anchor base to floor with reinforcing bars set in floor at tie of pouring of floor or with power driven studs. Set required equipment anchor bolts in base at time of pouring.

3.03 LINTELS

A. All steel lintels required for opening in existing and/or new masonry walls shall be provided under Section 05 50 00 – Metal Fabrications. This contractor shall design, fabricate, and install all lintels required in masonry walls for conduit and cable tray penetrations. Contractor shall submit design drawings of lintels with professional engineers' seal and signature prior to installation.

3.04 BUILDING ACCESS

A. Arrange for the necessary openings in the building to allow for admittance of all apparatus. When the building access was not previously arranged and must be provided by this contractor, restore any opening to its original condition after the apparatus has been brought into the building.

3.05 EQUIPMENT ACCESS

A. Install all piping, conduit, ductwork, and accessories to permit access to equipment for maintenance. Coordinate the exact location of wall and ceiling access panels and doors with the General Contractor, making sure that access is available for all equipment and specialties. Where access is required in plaster or drywall walls or ceilings, furnish the access doors to the General Contractor and reimburse the General Contractor for installation of those access doors.
B. The approximate location of all equipment and devices is shown on the drawings. The Architect/Engineer reserves the right to change the location of all equipment or devices 6 feet in any direction at no additional cost provided such changes are requested before final installation.
C. Install all equipment with ample space allowed for removal and repair. Provide ready accessibility to removable parts of equipment and to all wiring without moving equipment which is installed or which is already in place.
D. In mechanical and electrical equipment spaces, expose ceiling outlets and conduit with due consideration to ventilating ducts and mechanical piping. Where numerous ducts occur, install conduits and outlets after the ventilating ducts. Puncturing of ductwork or hanging equipment such as light fixtures, ceiling hangers and conduits from ductwork is prohibited unless specifically noted otherwise.
E. Electrical equipment shall be installed to maintain minimum clearances per Article 110 of NEC and ANSI C2 (National Electrical Safety Code).
F. No piping carrying fluids shall be installed directly over electrical equipment.
G. Equipment shall be installed in accordance with manufacturer's recommendation. Where conflicts occur between Contract Document and these recommendations, a ruling shall be requested of the Architect for decision before proceeding with such work.

3.06 COORDINATION

A. The Contractor shall cooperate with other trades in locating work in a proper manner. Should it be necessary to raise or lower or move longitudinally any part of the electrical work to better fit the general installation, such work shall be done at no extra cost to the Owner, provided such decision is reached prior to actual installation. The Contractor shall check location of electrical outlets with respect to other installations before installing.
B. The Contractor shall verify that all devices are compatible for the surfaces on which they will be used. This includes, but is not limited to light fixtures, panelboards, devices, etc. and recessed or semi-recessed heating units installed in/on architectural surfaces. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls and other structural components as they are constructed.
C. Coordinate all work with other contractors prior to installation. Any installed work that is not coordinated and that interferes with other contractor's work shall be removed or relocated at the installing contractor's expense.
D. Coordinate arrangements, mounting and support of electrical equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting raceways, cables, wireways, cable trays and busways will be clear of obstructions and of the working and access space of other equipment.

E. Coordinate with Division 27 and 28 contractors and equipment vendors for proper location, quantity and capacity of all required conduits, back boxes, device rings and power supplies required to support systems specified.

F. Cooperate with the testing consultant in ensuring Section 26 05 04 compliance. Verify system completion to the testing consultant. Demonstrate the starting, interlocking and control features of each system so the testing contractor can perform its work.

3.07 SLEEVES AND OPENINGS

A. General:
1. Sleeves are not required for piping and ducts passing through interior non-rated drywall, plaster, or wood partitions and interior poured concrete walls that have been saw cut or core drilled.
2. Pack annular space between sleeves and pipe or ducts with fiberglass insulation and seal.
3. Piping sleeves that pass through fire rated floors, walls, or ceilings shall be provided with a UL listed fire stop material meeting UL 1479 to seal the opening between the pipe and the pipe sleeve to maintain the fire rating.
4. Provide escutcheon plates on piping to cover sleeve and insulation in finished areas.
5. Refer to Division 1, General Requirements for additional information on sleeves and openings.

B. Sleeves Through Floors/Ceilings:
1. Sleeves shall be installed to extend 1 inch above finished floor with a watertight sealant between floor and sleeve in all mechanical rooms and wet rooms listed below.
2. If a sleeve is not provided, provide 1-1/2 inch angle ring with urethane caulk between the angle and the floor and seal at the corners to form a watertight seal.
3. Wet Locations:
   a. Mechanical Rooms
   b. Parking Ramps
   c. Sanitary pumping stations
   d. Swimming pool equipment rooms
   e. Chemical storage and hazardous waste storage rooms
   f. Food service/kitchen areas (behind/under equipment, cabinets, tables, etc.)

3.08 SEALING AND FIRESTOPPING

A. The Contractor shall refer to building life safety drawings for all smoke and fire rates in addition to the mechanical drawings. Any discrepancies shall be brought to the attention of the Architect/Engineer before final addendum.

B. Fire and/or Smoke Penetrations:
1. Install approved product in accordance with the manufacturer's instructions where a pipe (i.e. cable tray, bus, cable bus, conduit, wireway, trough, etc.) penetrates a fire rated surface.
2. Where firestop mortar is used to infill large fire-rated floor openings that could be required to support weight, provide permanent structural forming. Firestop mortar alone is not adequate to support any substantial weight.

C. Non-Rated Surfaces:
1. When the opening is through a non-fire rated wall, floor, ceiling or roof the opening must be sealed using an approved type of material.
2. Install escutcheons or floor/ceiling plates where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces for this paragraph include only those rooms with finished ceilings and the penetration occurs below the ceiling.
3. In exterior wall openings below grade, assemble rubber links of mechanical seal to the proper size for the conduit and tighten in place, in accordance with the manufacturer's instructions. Install so that the bolts used to tighten the seal are accessible from the interior of the building or vault.

4. At interior partitions, conduit penetrations are required to be sealed for all clean rooms, laboratories, and most hospital spaces, computer rooms, dormitory rooms, tele/data/com rooms and similar spaces where the room pressure or odor transmission must be controlled. Apply sealant to both sides of the penetration in such a manner that the annular space between the conduit sleeve and the conduit is completely filled.

3.09 HOUSEKEEPING AND CLEAN UP

A. The Contractor shall clean up and remove from the premises, on a daily basis, all debris and rubbish resulting from its work and shall repair all damage to new and existing equipment resulting from its work. When job is complete, this Contractor shall remove all tools, excess material and equipment, etc., from the site.

END OF SECTION

SECTION 26 05 04
CLEANING, INSPECTION, AND TESTING OF ELECTRICAL EQUIPMENT

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. The work under this section includes the required cleaning, repair, adjustment, calibration, maintenance and testing of electrical equipment, as specified herein. This applies only to new electrical and existing electrical equipment being furnished, modified, worked on or serviced by this contractor for this project. Additional testing may be required and specified in other Division 26 sections and shall also be provided.

1.02 SECTION INCLUDES

A. General Inspection and Cleaning of All Electrical Equipment
B. Grounding Systems
C. Metering and Instrumentation
D. Mechanical and Electrical Interlock System
E. Cables
F. Panelboards
G. Light Fixtures
H. Occupancy Sensors
I. Battery Pack Emergency Lighting
J. UPS System
K. Motor Starters and Motor Control Centers

1.03 RELATED WORK

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
B. Section 26 05 00 – Common Work Results for Electrical
C. Division 27 – Communications
D. Division 28 – Electronic Safety & Security

PART 2 – PRODUCTS

2.01 NOT USED.

PART 3 – EXECUTION

3.01 GENERAL INSPECTION AND CLEANING OF ALL ELECTRICAL EQUIPMENT

A. Inspect for physical damage and abnormal mechanical and electrical conditions.
B. Any item found to be out of tolerance, or in any other way defective as a result of the required testing, shall be reported to the A/E. Procedure for repair and/or replacement will be outlined. After appropriate corrective action is completed the item shall be re-tested.
C. Compare equipment nameplate information with the latest single line diagram and report any discrepancies.
D. Verify proper auxiliary device operation and indicators.
E. Check tightness of accessible bolted electrical joints. Use torque wrench method.
F. Make a close examination of equipment and remove any shipping brackets, insulation, packing, etc. that may not have been removed during original installation.
G. Make a close examination of equipment and remove any dirt or other forms of debris that may have collected in existing equipment or in new equipment during installation.
H. Clean All Equipment:

1. Vacuum inside of panelboards, switchboards, switchgear, transformer core and coils, horizontal and vertical busducts, motor control centers (MCC)'s, fire alarm panels, comm/data, security panel, etc.
2. Loosen attached particles and vacuum them away.
3. Wipe all insulators with a clean, dry, lint free rag.
4. Clean insulator grooves.
5. Re-vacuum inside surfaces as directed by the Owner's Construction Representative or Inspector

I. Inspect equipment anchorage.
J. Inspect equipment and bus alignment.
K. Check all overload elements for operation and control.
L. Lubricate nonelectrical equipment per manufacturer's recommendations.

3.02 GROUNDING SYSTEMS

A. Inspect the ground system for adequate termination at all devices.

3.03 METERING AND INSTRUMENTATION

A. Examine all devices for broken parts, damage and wire connection tightness.
B. Meter selector switches shall be inspected for proper application and operation.

3.04 MECHANICAL AND ELECTRICAL INTERLOCK SYSTEM

A. Physically test each system to insure proper function, operation and sequencing.
B. Closure attempt shall be made on locked open devices.
C. Opening attempt shall be made on locked closed devices.
D. Key exchange shall be made with devices operated in off normal positions.

3.05 CABLES

A. Visual and Mechanical Inspections:
   1. Inspect exposed sections for physical damage.
   2. Verify cable is supplied and connected in accordance with single line diagram.
   3. Inspect for shield grounding, cable support and termination.
   4. If cables are terminated through window type C.T.'s make an inspection to verify that neutrals and grounds are properly terminated for normal operation of protective devices.
   5. Inspect for visual jacket and insulation condition.
   6. Visible cable bends shall be checked against ICEA or manufacturer's minimum allowable bending radii -- 12 times the diameter for tape shielded cables.
   7. Inspect for proper fireproofing in common cable areas.
   8. There shall be NO tests performed on existing cable without specific direction from the Consulting Engineer.
B. Electrical Tests -- Below 600 Volts:
   1. All secondary cables from the substation transformers to the secondary switchboards shall be subjected to insulation tests using a 500 vdc megger.
   2. Visually inspect cables, lugs, connectors and all other components for physical damage and proper connections
   3. Check all cable connectors for tightness (with a torque wrench) and clearances. Torque test conductor and bus terminations to manufacturer's recommendations.
   4. Check for proper grounding resistance at all services and at transformers. Resistance shall be 2 ohms maximum.

3.06 PANELBOARDS

A. Torque all the connections per the manufacturers spec. Verify phase wires, color coding, separate neutral and mechanical bonding. Verify circuit breaker operation. Verify the directory.

3.07 LIGHT FIXTURES

A. Check the bonding and proper lamping. Verify that recessed fixtures are installed with hold down clips. Confirm operation of the fixture with the proper switch or sensor.

3.08 OCCUPANCY SENSORS

A. Confirm operation of the sensor per the manufacturers spec.

3.09 BATTERY PACK EMERGENCY LIGHTING

A. Verify the operation per the manufacturers spec and run all of the diagnostic steps. Confirm proper grounding and location.

3.10 UPS SYSTEM

A. Operate and test the system per the manufacturers spec. Confirm the batteries and liquid level along with the transfer scheme.

3.11 MOTOR STARTERS AND MOTOR CONTROL CENTERS

A. Verify the control circuits. Confirm the fusing and the grounding of the control transformers. Torque all of the connections. Confirm the overload elements and the circuit breakers(fuse) for proper sizing. Verify all grounding. Operate and test each motor starter for proper operation.

END OF SECTION

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SECTION 26 05 19
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLE

PART 1 – GENERAL

1.01 SCOPE OF WORK
A. The work under this section includes furnishing and installing required wiring and cabling systems including pulling, terminating and splicing.

1.02 SECTION INCLUDES
A. General
B. Manufacturers
C. Building Wire
D. Underground Wire for Interior & Exterior Work
E. Wiring Connectors

1.03 RELATED WORK
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
B. Section 26 05 00 – Common Work Results for Electrical
C. Section 26 05 26 – Grounding and Bonding for Electrical Systems
D. Section 26 05 33 – Raceway and Boxes for Electrical Systems.
E. Section 26 05 53 – Identification for Electrical Systems.

1.04 REFERENCE STANDARDS
A. NFPA 70 - National Electrical Code
B. IPCEA S-61-402/NEMA WC-5 Thermoplastic Insulated Wire and Cable
C. IPCEA S-66-524/NEMA WC-7 Cross-linked Thermosetting Polyethylene-Insulated Wire and Cable
D. UL 83
E. ASTM

1.05 FUNCTIONAL PERFORMANCE TESTS
A. Refer to Section 26 05 00 – Common Results for Electrical – Functional Performance Tests
B. Acceptance tests shall be performed in accordance with the current version of ASNI/NETA ATS and by an independent testing agency. Specify only the independent testing agencies listed in the latest electrical Trades Preferred Manufacturers List.
C. Tests shall be performed in accordance with applicable codes, standards, and equipment manufacturers' instructions.
D. The Contractor shall provide all test equipment, materials and labor necessary to perform the tests, and shall coordinate with the other trades for necessary services, such as scaffolding and the uncoupling of motors.
E. Tests shall consist of visual inspections, manual operations, and electrical testing under all normal and expected abnormal operating conditions.
F. The A/E & Owner shall be notified a minimum of 3 working days in advance of all tests. Tests shall be witnessed by the owner unless such witnessing is waived in writing.
G. The A/E & Owner shall be provided with a written test report, signed and dated, for all tests. Include a copy of the test report with O&M manual.

1.06 PROJECT CONDITIONS
A. Verify that field measurements are as shown on Drawings.
B. Conductor sizes are based on copper. Where aluminum conductors are being substituted for copper, contractor shall submit a substitution schedule (wire and conduit substitutions) for the feeder schedule.
C. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet project conditions.

D. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

PART 2 – PRODUCTS

2.01 GENERAL

A. All wire shall be new, delivered to the site in unbroken cartons and shall be less than one year old out of manufacturer's stock.
   a. **Aluminum and Copper** Conductors: Comply with NEMA WC 70/ICEA S-95-658.
B. All cable and wire shall have 600 volts insulation, have a conductivity of 98 percent, and copper cables shall be annealed coated per ASTM B33 or B189.
C. Wire sizes No. 12 AWG and smaller shall be solid wire, and wire No. 10 AWG and larger shall be stranded, Class B, ASTM B8.
D. Stranded conductors may only be terminated with UL OR ETL Listed type terminations or methods: e.g. stranded conductors may not be wrapped around a terminal screw but must be terminated with a crimp type device or must be terminated in an approved back wired method.
E. Minimum wire sizes shall be as follows:
   1. Power wiring- #12 AWG
   2. Control Wiring- #18 AWG
F. All conductors shall be continuous without splices except at locations approved for the purpose.

2.02 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:
   1. Alcan Products Corporation; Alcan Cable Division
   2. American Insulated Wire Corp.; a Leviton Company
   3. General Cable Corporation
   4. Senator Wire & Cable Company
   5. Southwire Company
   6. Houston Wire & Cable
   7. AFC Cable Systems, Inc.
   8. Hubbell Power Systems, Inc.
   9. O-Z/Gedney; EGS Electrical Group, LLC
   10. 3M; Electrical Products Division
   11. Tyco Electronics Corp.

2.03 INTERIOR BUILDING WIRE

A. Description: Single conductor insulated wire.
B. Insulation:
   1. Copper - Type THHN/THWN, XHHW-2.
   2. Aluminum - Type XHHW-2.

2.04 VARIABLE FREQUENCY DRIVE (VFD) WIRE

A. All power wiring from the VFD output to the motor shall be type XHHW-2 insulation, single conductor wire.

2.05 UNDERGROUND WIRE FOR INTERIOR AND EXTERIOR WORK

A. Description: Single conductor insulated wire.
B. Insulation:
   1. Copper - Type XHHW-2
   2. Aluminum – Type XHHW-2

2.06 METAL CLAD CABLE

A. Type MC Cable may be non-emergency circuits for 15 and 20 ampere branch circuit wiring systems beyond the first outlet box.

B. Provide metal clad cable (Type MC) that complies with UL Standard 1569 – Metal Clad Cables, the NEC and this section.
C. Type MC cable shall consist of THHN insulated solid copper circuit conductors, an insulated solid copper equipment grounding conductor, a Mylar wrapping around the conductor bundle and a close-fitting aluminum or galvanized steel outer sheath.
D. Provide minimum 12 AWG conductors in Type MC cable.
   1. Provide larger conductor sizes as required to limit branch circuit voltage drop to 3 percent at the full connected load.
   2. Use larger conductor sizes to adjust allowable ampacity if there are more than 3 current carrying conductors in a cable.
E. Provide Type MC cable with the same conductor color coding as specified for BUILDING WIRE.
F. Provide NRTL listed, insulated throat, snap-in steel box connectors for Type MC cable.

2.07 WIRING CONNECTORS

A. Split Bolt Connectors: Not acceptable.
B. Solderless Pressure Connectors: High copper alloy terminal. May be used only for cable termination to equipment pads or terminals. Not approved for splicing.
C. Spring Wire Connectors: Solderless spring type pressure connector with insulating covers for copper wire splices and taps. Use for conductor sizes 10 AWG and smaller.
D. All wire connectors used in underground or exterior pull boxes shall be gel filled twist connectors or a connector designed for damp and wet locations.
E. Mechanical Connectors: Bolted type tin-plated; high conductivity copper alloy; spacer between conductors; beveled cable entrances.
F. Compression (crimp) Connectors: Long barrel; seamless, tin-plated electrolytic copper tubing; internally beveled barrel ends. Connector shall be clearly marked with the wire size and type and proper number and location of crimps.

PART 3 – EXECUTION

3.01 GENERAL WIRING METHODS

A. All wire and cable shall be installed in conduit.
B. Do not use wire smaller than 12 AWG for power and lighting circuits.
C. All conductors shall be sized to prevent excessive voltage drop at rated circuit ampacity. As a minimum use 10 AWG conductor for 20 ampere, 120 volt branch circuit home runs longer than 100 feet (30 m), and for 20 ampere, 277 volt branch circuit home runs longer than 200 feet (61 m).
D. Make conductor lengths for parallel conductors equal.
E. Splice only in junction or outlet boxes.
F. No conductor less than 10 AWG shall be installed in exterior underground conduit.
G. Identify ALL low voltage, 600v and lower, wire per section 26 05 53.
H. Neatly train and lace wiring inside boxes, equipment, and panelboards.
I. Aluminum conductors may be substituted for feeders, 100 amps or larger.
   1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.

3.02 WIRING INSTALLATION IN RACEWAYS

A. Pull all conductors into a raceway at the same time. Use Listed wire pulling lubricant for pulling 4 AWG and larger wires and for other conditions when necessary.
B. Install wire in raceway after interior of building has been physically protected from the weather and all mechanical work likely to injure conductors has been completed.
C. Completely and thoroughly swab raceway system before installing conductors.
D. Place all conductors of a given circuit (this includes phase wires, neutral (if any), and ground conductor) in the same raceway. If parallel phase and/or neutral wires are used, then place an equal number of phase and neutral conductors in same raceway or cable.

3.03 METAL CLAD CABLE INSTALLATION

A. Install Type MC cable according to NECA 120, Standard for installing and Maintaining Armored Cable (Type AC) and Metal Clad Cable (Type MC) (ANSI), the NEC and requirements in this Section.
B. Route Type MC cable to meet project conditions.
C. Use Type MC cable for 15- and 20-ampere branch circuit wiring beyond the first outlet or junction box; however, use conduit for the "homerun" from the first outlet or junction box to the branch circuit panelboard. Metal Clad Cable is not permitted to be used above ceilings.
D. Use Type MC cable in interior, dry locations where it will be concealed in dry-wall partitions, in equipment enclosures or below raised floors.
E. Install and support Type MC cable as required in Article 330 of the NEC. Use NRTL listed spring steel Type MC cable supports to support Type MC cable; do not use wire or plastic zip-ties to support Type MC cable.

3.04 WIRING CONNECTIONS AND TERMINATIONS

A. Splice only in accessible junction boxes.
B. Wire splices and taps shall be made firm, and adequate to carry the full current rating of the respective wire without soldering and without perceptible temperature rise.
C. All splices shall be so made that they have an electrical resistance not in excess of two feet (600 mm) of the conductor.
D. Use solderless spring type pressure connectors with insulating covers for wire splices and taps, 10 AWG and smaller.
E. Use mechanical or compression connectors for wire splices and taps, 8 AWG and larger. Tape uninsulated conductors and connectors with electrical tape to 150 percent of the insulation value of conductor.
F. Thoroughly clean wires before installing lugs and connectors.
G. At all splices and terminations, leave tails long enough to cut splice out and completely re-splice.

3.05 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 26 05 04.
B. Additional testing as follows shall be performed if aluminum conductors are used:
   1. Equipment terminated with aluminum conductors shall be tested with a thermal imager and recorded.
C. Conductors shall be closely checked for loose or poor connections, and for signs of overheating or corrosion.
D. Test procedures shall meet NETA guidelines.
E. Test results and report shall be provided to the engineer.
F. Contractor shall correct all deficiencies reported in the test report.

3.06 WIRE COLOR

A. General:
   1. For wire sizes 10 AWG and smaller - Wire shall be colored as indicated below.
   2. For wire sizes 8 AWG and larger – Use colored wire, or identify wire with colored tape at all terminals, splices and boxes. Colors to be as indicated below.
   3. In new facilities, use Phase A black, Phase B red and Phase C blue for circuits at 120/208 volts single or three phase. Note: This includes fixture whips except for Listed whips mounted by the fixture manufacturer on the fixture and Listed as a System.
   4. All switch legs shall be the same color as their associated circuit. Traveler conductors run between 3 and 4 way switches shall be colored pink or purple.
B. Neutral Conductors: White for 120/208V. Where there are two or more neutrals in one conduit, each shall be individually identified with a different stripe with the stripe color matching the corresponding phase conductor color.
C. Branch Circuit Conductors: Three or four wire home runs shall have each phase uniquely color coded.
D. Feeder Circuit Conductors: Each phase shall be uniquely color coded.

E. Ground Conductors: Green for 6 AWG and smaller. For 4 AWG and larger, identify with green colored wire, or with green tape at both ends and at all access points, such as panelboards, motor starters, disconnects and junction boxes. When isolated grounds are required, contractor shall provide green with yellow tracer.

3.07 BRANCH CIRCUITS

A. The use of single-phase, multi-wire branch circuits with a common neutral are not permitted. All branch circuits shall be furnished and installed with an individual accompanying neutral, sized the same as the phase conductors.

3.08 EMERGENCY CIRCUITS

A. All emergency system wiring (level 1 and level 2) shall be installed in separate raceways after their associated inverters. The wiring shall be separate from each other and from all normal system wiring.

END OF SECTION

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SECTION 26 05 23
CONTROL-VOLTAGE ELECTRICAL POWER CABLES

PART 1 – GENERAL

1.01 SCOPE OF WORK
A. The work under this section includes furnishing and installing required remote control and signal cabling.

1.02 SECTION INCLUDES
A. General
B. Manufacturers
C. Remote Control and Signal Cable
D. Wiring Connectors

1.03 RELATED WORK
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
B. Section 26 05 00 – Common Work Results for Electrical
C. Section 26 05 33 – Raceway and Boxes for Electrical Systems
D. Section 26 05 53 – Identification for Electrical Systems

1.04 SUBMITTALS
A. Submit product data: Provide for each cable assembly type.
B. Submit manufacturer's installation instructions. Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements.

1.05 REFERENCE STANDARDS
A. NFPA 70 - National Electrical Code

1.06 PROJECT CONDITIONS
A. Verify that field measurements are as shown on Drawings.
B. Conductor sizes are based on copper.
C. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet Project Conditions.
D. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

PART 2 – PRODUCTS

2.01 GENERAL
A. All wire shall be new, delivered to the site in unbroken cartons and shall be less than one year old out of manufacturer's stock.
B. All conductors shall be copper.
C. Insulation shall have a 600 volt rating.
D. All conductors must be suitable for the application intended. Conductors #12 and smaller may be solid or stranded with the following requirements or exceptions:
E. All conductors terminated with crimp type devices must be stranded.
F. Stranded conductors may only be terminated with UL OR ETL Listed type terminations or methods: e.g. stranded conductors may not be wrapped around a terminal screw but must be terminated with a crimp type device or must be terminated in an approved back wired method.

2.02 MANUFACTURERS
A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:

1. Alcan Products Corporation; Alcan Cable Division
2. American Insulated Wire Corp.; a Leviton Company
3. General Cable Corporation
4. Senator Wire & Cable Company
5. Southwire Company
6. Houston Wire & Cable

2.03 REMOTE CONTROL AND SIGNAL CABLE

A. Refer to Section 28 31 00 for requirements for cable to be used on fire alarm systems.
B. Refer to Section 27 00 00 for requirements for cable to be used on communication systems.
C. All other systems cabling shall meet the requirements of NEC Article 725 and the following:
   1. Control Cable for Class 1 Remote Control and Signal Circuits: 600 volt insulation, individual conductors twisted together, and covered with an overall PVC jacket. Cable shall be Listed, temperature rated, and plenum or non-plenum rated for the application as required in the National Electrical Code.
   2. Control Cable for Class 2 or Class 3 Remote Control and Signal Circuits shall be constructed, Listed, temperature rated, and plenum or non-plenum rated for the application as required in the NEC Article 725.

2.04 WIRING CONNECTORS

A. Split Bolt Connectors: Not acceptable.
B. Spring Wire Connectors: Solderless spring type pressure connector with insulating covers for copper wire splices and taps. Use for conductor sizes 10 AWG and smaller.
C. All wire connectors used in underground or exterior pull boxes shall be gel filled twist connectors or a connector designed for damp and wet locations.

PART 3 – EXECUTION

3.01 GENERAL WIRING METHODS

A. Low voltage control and signal cables shall be installed in conduit. However, they may be installed without conduit above accessible ceilings if the cable meets NEC requirements for the application, unless specified to be in conduit in other sections of the specifications. See requirements for free-air cabling installation below.
B. Do not use wire smaller than 14 AWG for control wiring greater than 60 volts, or 18 AWG for voltages less than 60 volts, all sizes subject to NEC 725 requirements.
C. Splice only in junction boxes.
D. Identify wire per section 26 05 53.
E. Neatly train and lace wiring inside boxes, and equipment.

3.02 WIRING INSTALLATION IN RACEWAYS

A. Pull all conductors into a raceway at the same time. Use Listed wire pulling lubricant for pulling conditions when necessary.
B. Install wire in raceway after interior of building has been physically protected from the weather and all mechanical work likely to injure conductors has been completed.
C. Completely and thoroughly swab raceway system before installing conductors.

3.03 FREE-AIR CABLE INSTALLATION

A. When permitted in exposed ceiling areas, 'Free-Air' wiring runs shall avoid areas of high traffic (i.e. aisle way), shall be run as close as possible to outlining walls and shall be a minimum of ten (10) feet above finished floor.
B. Cabling shall be neatly run at right angles and be kept clear of other trades work.
C. Cabling shall be supported at a maximum of 4-foot intervals utilizing 'bridal-type' mounting rings anchored to ceiling concrete, piping supports or structural steel beams. If cable sag at mid-span exceeds 12-inches, another support shall be provided. Mounting rings shall be designed to maintain cables bend to larger than the minimum bed radius (typically 4 x cable diameter).

D. Cabling shall not be attached to or supported by existing cabling, plumbing or steam piping, ductwork, suspended ceiling supports or electrical conduit. Additionally, cabling shall not be laid directly on the ceiling grid.
E. To reduce or eliminate Electro-Magnetic Interference (EMI), the following minimum separation distances for 'Free-Air' cabling installations shall be adhered to:
   1. Twelve (12) inches from power lines of less than 5kV.
   2. Thirty-nine (39) inches from power lines of 5kV or greater.
   3. Eighteen (18) inches from lighting fixtures.
   4. Thirty-nine (39) inches from transformers and motors.
F. A coil of 2 feet in each cable shall be placed in the ceiling at each 'free-air' wired device. These coils shall be secured (wire tied) at the last cable support before the cable reaches the device and shall be coiled from 100% to 200% of the cable recommended minimum bend radius.
G. All cable shall be free of tension at both ends. Nylon strain relief connectors shall be provided at each device and junction box where cables enter. In cases where the cable must bear some stress, Kellum type grips may be used to spread the strain over a longer length of cable.
H. Cable manufacturers minimum bend radius shall be observed in all instances. Care should be taken in the use of cable ties to secure and anchor the station cabling. Ties should not be over tightened as to compress the cable jacket. No sharp burrs should remain where excess length of the cable tie has been cut.
I. All exposed vertical cable extensions to devices located below the finished ceiling shall be in conduit.
J. Provide protection for exposed cables where subject to damage.
K. Use suitable cable fittings and connectors.

3.04 WIRING CONNECTIONS AND TERMINATIONS

A. Splice only in accessible junction boxes.
B. All splices shall be so made that they have an electrical resistance not in excess of two feet (600 mm) of the conductor.
C. Use solderless spring type pressure connectors with insulating covers for wire splices and taps, 10 AWG and smaller.
D. Thoroughly clean wires before installing lugs and connectors.
E. At all splices and terminations, leave tails long enough to cut splice out and completely re-splice.

3.05 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 26 05 04.

END OF SECTION

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SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.01 SCOPE OF WORK
A. The work under this section includes grounding electrodes, connectors, equipment grounding conductors, bus and bonding.

1.02 SECTION INCLUDES
A. Manufacturers
B. Rod Electrode
C. Mechanical Connectors
D. Compression Connectors
E. Exothermic Connections
F. Wire
G. Bus

1.03 RELATED WORK
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
B. Section 26 05 00 – Common Work Results for Electrical

1.04 SUBMITTALS
A. Product Data: Provide data for grounding electrodes and connections.
B. Test Reports: Indicate overall resistance to ground [and resistance of each electrode].
C. Manufacturer's Instructions: Include instructions for preparation, installation and examination of exothermic connectors.

1.05 REFERENCE STANDARDS
A. NFPA 70 - National Electrical Code.
B. ANSI/IEEE 142 (Latest edition) - Recommended Practice for Grounding of Industrial and Commercial Power Systems.

1.06 FUNCTIONAL PERFORMANCE TESTING
A. Tests shall be performed in accordance with applicable codes, standards, and equipment manufacturers' instructions.
B. The Contractor shall provide all test equipment, materials, and labor necessary to perform the tests.
C. Tests shall consist of visual inspections, manual operations, and electrical testing under all normal and expected abnormal operating conditions.
D. The resistance to ground shall be measured using either the three-point method or the fall-of-potential method.
E. Grounding System Resistance: 2ohms maximum at building service entrance.
F. Testing of grounding system resistance is to be witnessed by the electrical inspector or Field Representative. Provide test report of grounding system resistance in final O&M manuals.

1.07 PROJECT RECORD DOCUMENTS
A. Accurately record actual locations of grounding electrodes.

1.08 REGULATORY REQUIREMENTS
A. Conform to requirements of NFPA 70.
B. Furnish products listed and classified by Underwriters Laboratories, Inc. or testing firm acceptable to authority having jurisdiction as suitable for purpose specified and shown.
C. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide by one of the following
   1. Burnoy
   2. Erico
   3. Schieder Sq. D
   4. Thomas Betts
   5. Panduit
   6. ILSCO.

2.02 ROD ELECTRODE

A. Material: Copper-clad steel.

B. Diameter: ¾ inch (19 mm) minimum.

C. Length: 10 feet (3.5 m) minimum. Rod shall be driven at least 9' 6" deep.

2.03 MECHANICAL CONNECTORS

A. The mechanical connector bodies shall be manufactured from high strength, high conductivity cast copper alloy material. Bolts, nuts, washers and lock washers shall be made of Silicon Bronze and supplied as a part of the connector body and shall be of the two bolt type.

B. Split bolt connector types are NOT allowed. Exception: the use of split bolts is acceptable for grounding of wire-basket type cable tray, and for cable shields/straps of medium voltage cable.

C. The connectors shall meet or exceed UL 467 and be clearly marked with the catalog number, conductor size and manufacturer.

2.04 COMPRESSION CONNECTORS

A. The compression connectors shall be manufactured from pure wrought copper. The conductivity of this material shall be no less than 99% by IACS standards.

B. The connectors shall meet or exceed the performance requirements of IEEE 837, latest revision.

C. The installation of the connectors shall be made with a compression, tool and die system, as recommended by the manufacturer of the connectors.

D. The connectors shall be clearly marked with the manufacturer, catalog number, conductor size and the required compression tool settings.

E. Each connector shall be factory filled with an oxide-inhibiting compound.

2.05 EXOTHERMIC CONNECTIONS

A. As manufactured by Cadweld or similar.

2.06 WIRE

A. Material: Stranded copper (aluminum not permitted).

B. Grounding Electrode Conductor: Size as shown on drawings, specifications or as required by NFPA 70, whichever is larger.

C. Foundation Electrodes: As shown on drawings.

D. Primary Manhole, Main Switchgear room and Vault Bonding: No. 4/0 minimum.

E. Feeder and Branch Circuit Equipment Ground: Size as shown on drawings, specifications or as required by NFPA 70, whichever is larger. Differentiate between the normal ground and the isolated ground when both are used on the same facility.

2.07 BUS

A. Material: Copper (aluminum not permitted).

B. Size: 1/4" X 2" minimum and 12” minimum length.

C. Provide insulated wall standoff – 2” minimum.

D. Pre-drilled holes.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that final backfill and compaction has been completed before driving rod electrodes.

3.02 GENERAL

A. Install Products in accordance with manufacturer's instructions.
B. Mechanical connections shall be accessible for inspection and checking. No insulation shall be installed over mechanical ground connections.
C. Ground connection surfaces shall be cleaned and all connections shall be made so that it is impossible to move them.
D. Attach grounds permanently before permanent building service is energized.
E. All grounding electrode conductors shall be installed in PVC conduit, in exposed locations.
F. Conductor Termination and Connections:
   1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
   2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.
   3. Connections to Ground Rods at Test Wells: Bolted connectors.
   4. Connection to Structural Steel: Welded connectors.

3.03 LESS THAN 600 VOLT SYSTEM GROUNDING

A. Refer to grounding one-line diagram on drawings.
B. Provide code sized copper grounding electrode conductor from secondary switchboard ground bus, each separately derived system neutral, secondary service system neutral to street side of water meter, building steel, ground rod, and any concrete encased electrodes. Provide bonding jumper around water meter.
C. Bond together system neutrals, service equipment enclosures, exposed non-current carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, receptacle ground connectors, and plumbing systems.
D. Equipment Grounding Conductor: Provide separate, insulated equipment grounding conductor within each raceway. Terminate each end on suitable lug, bus, enclosure or bushing. Provide a ground wire from each device to the respective enclosure.
E. Provide communications system grounding conductor at point of service entrance and connect to building common grounding electrode system.
F. Telecommunications and Audio-Visual systems shall be installed with an isolated grounding system which has only one ground point. That ground point is to be the common grounding electrode system at the electrical service entrance for the building. Contractor is to provide an isolated grounding conductor from the electrical service entrance of the building to each Telecommunications Grounding Bus Bar (TGBB) in each Telecommunication Room. Use a minimum No. 2/0 AWG copper conductor, or as indicated on the plans, for the telecommunications service grounding conductor. Leave 10 feet slack grounding conductor at each Telecommunications Room. The grounding conductor MUST NOT be attached to building steel (except as allowed at the main electrical service entrance).
G. Telecommunications Equipment Rack Grounding: Use a #6 or larger AWG copper conductor from all telecommunications cabinets and racks to the Telecommunications Grounding Bus Bar (TGBB) in each Telecommunication Room.

3.04 FIELD QUALITY CONTROL

A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

END OF SECTION

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SECTION 26 05 29
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SCOPE OF WORK
A. The work under this section includes conduit and equipment supports, straps, clamps, steel channel, etc., and all required fastening hardware for supporting electrical work.

1.02 SECTION INCLUDES
A. Support, Anchorage and Attachment Components
B. Manufacturers

1.03 RELATED WORK
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
B. Section 26 05 00 – Common Work Results for Electrical
C. Section 26 05 19 – Low-Voltage Electrical Power Conductors and Cables
D. Section 26 05 23 – Control Voltage Electrical Power Cables
E. Section 26 05 26 – Grounding and Bonding for Electrical Systems
F. Section 26 05 33 – Raceway and Boxes for Electrical Systems
G. Section 26 05 36 – Cable Trays for Electrical Systems
H. Section 26 24 16 – Panelboards
I. Section 26 27 26 – Wiring Devices
J. Section 26 27 28 – Disconnect Switches
K. Section 26 51 13 -Interior Lighting Fixtures, Lamps and Ballasts

1.04 QUALITY ASSURANCE
A. Support systems shall be adequate for weight of equipment and conduit, including wiring, which they carry.
B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, “Structural Welding Code – Steel”.

1.05 PERFORMANCE REQUIREMENTS
A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.06 COORDINATION
A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement and formwork requirements are specified in Division 03.
B. Coordinate installation of roof curbs, equipment supports and roof penetrations as specified in Division 07 Section “Roof Accessories”.

PART 2 - PRODUCTS

2.01 MATERIAL
A. Support Channel
   1. Epoxy Painted:

a. Strut shall be made from steel meeting the minimum mechanical properties of ASTM A1011 SS Grade 33, then painted with water born epoxy applied by a cathodic electro-deposition process.
b. All fittings and hardware shall be zinc plated in accordance with ASTM B633 (SC3 for fittings, SC1 for threaded hardware).

2. Hot-dip Galvanized Steel:
   a. Strut shall be made from steel meeting the minimum mechanical properties of ASTM A1011 SS, Grade 33 and shall be hot-dip galvanized after fabrication in accordance with ASTM A123.
   b. Fittings shall be manufactured from steel meeting the minimum requirements of ASTM A907 SS, Grade 33, and hot-dip galvanized after fabrication in accordance with ASTM A123.
   c. All hardware shall be stainless steel Type 304 or chromium zinc ASTM F1136 Gr. 3.
   d. All hot-dip galvanized after fabrication products must be returned to point of manufacture after coating for inspection and removal of all sharp burrs.
3. Stainless Steel:
   a. All strut, fittings and hardware shall be made of AISI Type 304 or Type 316 stainless steel as indicated.

B. Conduit Supports
1. Conduit clamps, straps, supports, etc., shall be steel or malleable iron.
2. One-hole straps shall be heavy duty type. All straps shall have steel or malleable backing plates when rigid steel conduit is installed on the interior or exterior surface of any exterior building wall.
3. Above suspended ceilings, bar joist conduit hangers: Spring Steel Clips with Snap-Close Clamps (Conduit Supports): Conduit clamps shall pivot a full 360 degrees and shall snap close around the conduit. Push-in type conduit clamps are not allowed. Spring clips shall require a hammer to install onto supporting surface.
4. Stud wall applications: Spring Steel Clips with Push-in or Snap-Close Conduit Clamps (Conduit Supports): Conduit clamps shall pivot a full 360 degrees. Spring clips shall require a fastener to install onto stud.
5. Box/conduit hanger with rod/wire clip (a.k.a. antlers): One assembly provides support for electrical box and conduit from drop wire or rod. Conduit clamps shall snap close around the conduit.
6. Spring Steel Clip products shall be provided with corrosion resistance and be warranted against failure from corrosion for a period of ten (10) years from date of manufacture.

C. Nylon anchors
1. Nylon anchors may only be used in limited applications with the pre-approval of the engineer of record. See Part 3 – Execution for examples of applications of where nylon anchors may be allowed.
2. Nylon wall plugs shall be designed for 2-way expansion, providing rapid fixing with high pull-out values. Nylon wall plugs shall be molded with protruding side fins which restrict rotation and prevent fall out from overhead holes. Examples of these include Mungo types MN or MU, or Fischer type S nylon plugs.
3. Nylon one-piece self-drilling anchors designed for use in hollow gypsum wallboard for light duty loads. Anchors shall be engineered nylon or Zamac alloy. Examples of these are the Zip-It ® or Zip-It Jr. ® self-drilling anchors.
4. Manufacturer's names and catalog numbers are used for quality and performance only. Anchors manufactured by others shall be equally acceptable provided they meet or exceed in performance and quality as specified.

D. Threaded Rod:
1. Minimum sized threaded rod for supports shall be 3/8” for trapezes and single conduits 1-1/4” and larger, and ¼” for single conduits 1” and smaller.

E. Hardware:
1. Corrosion resistant, or as noted for each product above.

2.02 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:
   1. Allied Tube & Conduit
   2. Cooper B-Line, Inc.; a Division of Cooper Industries
   3. ERICO International Corporation
   4. GS Metals Corp.
   5. Thomas & Betts Corporation
   6. Unistrut; Tyco International, Ltd.
   7. Wesanco, Inc.
   8. Fabco Plastics Wholesale Limited
   9. Seasafe, Inc.
   10. Empire Tool & Manufacturing Co.
   11. Hilti, Inc.
   12. ITW Ramset/Red Head; a Division of Illinois Tool Works, Inc.
   13. MKT Fastening, LLC
   14. Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit

PART 3 - EXECUTION

3.01 INSTALLATION

A. Fasten hanger rods, conduit clamps, and outlet-, junction-, and pull-boxes to building structure using pre-cast insert system, preset inserts, beam clamps, or expansion anchors.
B. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchors on concrete surfaces; sheet metal screws in sheet metal studs and wood screws in wood construction. If nail-in anchors are used, they must be removable type anchors.
C. Powder-actuated fasteners are not permitted.
D. Do not fasten supports to piping, ductwork, mechanical equipment, cable tray or conduit. Do not fasten to suspended ceiling grid system.
E. Do not drill structural steel members.
F. In wet locations, mechanical rooms, and electrical rooms, install free-standing electrical equipment on 3.5-inch (89 mm) concrete pads.
G. Install surface-mounted cabinets and panelboards with a minimum of four anchors. At all cabinet and panelboard locations on concrete or concrete block walls, and at ALL locations below grade, provide steel channel supports to stand cabinet one inch (25 mm) off wall (7/8" Uni-strut or 3/4" painted fire-retardant plywood is acceptable). In above-grade equipment rooms that have drywall walls, the cabinets and panelboards may be mounted to the drywall if backing is provided in the stud walls behind the equipment.
H. Bridge studs top and bottom with channels to support flush-mounted cabinets and panelboards in stud walls.
I. Furnish and install all supports as required to fasten all electrical components required for the project, including free standing supports required for those items remotely mounted from the building structure, catwalks, walkways etc.
J. Fabricate supports from galvanized structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.
K. Support Channel
   1. Use one of the following types of support channel as appropriate for the installed environment:
      a. Indoor: Epoxy Painted Steel, Hot-dipped Galvanized Steel, or as noted on the drawings.
      b. Exterior and wet locations: Hot-dipped Galvanized Steel or Stainless Steel, as appropriate for the environment or as noted on the drawings. Type 316 stainless steel shall be used for Food Service type environments. Epoxy painted support channel shall not be used for exterior installations.
      c. Manholes, steam pits, steam tunnels, or corrosive environments: Stainless Steel Type 316.

d. Field cuts: File and de-bur cut ends of support channel and paint to prevent rusting. For epoxy-painted support channel, paint cut ends to match the original color. For hot-dipped galvanized support channel, spray cut ends with cold galvanized paint.

L. Support Wires
1. Support wires that are installed in addition to the ceiling grid support wires to provide secure support for raceways, cables assemblies, boxes, cabinets, and fittings shall be secured at both ends (e.g. the ceiling structure at the top and the ceiling grid at the bottom) per NEC 300.11(A).
2. Compressed-air power-actuated fasteners may ONLY be used for the installation of separate ceiling wires required for support of conduits and aircraft cable hung light fixtures.
3. Support wires shall be identified per specification section 26 05 53.

M. Spring Steel Clip Conduit Supports
1. Above suspended ceilings: Spring steel clips with snap-close clamps may be used to support conduit from bar joist (steel truss) systems above suspended ceilings.
2. Stud wall applications: Spring steel clips with push-in or snap-close conduit clamps may be used to support conduit in interior metal stud wall applications. Use screw fasteners to install conduit clamp onto stud.
3. Box/conduit hanger with rod/wire clip (a.k.a. antlers): These may only be used in limited applications with the pre-approval of the engineer of record.

N. Nylon anchor applications
1. Nylon anchors may only be used in limited light duty applications with the pre-approval of the engineer of record.
2. Nylon anchors shall be designed for the construction material in which they are intended to be installed, and shall be designed for the weight in which the anchors are intended to support.
3. Nylon wall plug applications may include attaching 4" square boxes or conduit straps to plaster-covered clay tile, drywall, or hollow concrete block. Screws used with nylon wall plugs shall be #10 minimum and shall be longer than the anchor.
4. Nylon one-piece self-drilling anchor applications may include attaching 4" square boxes or conduit straps to hollow gypsum wallboard for light duty loads. Use No. 8 screws with one-piece self-drilling anchors designed for 3/8" to 1" thick wallboard. Use No. 6 screws with anchors designed for 3/8" to 5/8" wallboard.

3.02 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.
B. Cut, fit and place miscellaneous metal supports accurately in location, alignment and elevation to support and anchor electrical materials and equipment.
C. Field Welding: Comply with AWS D1.1/D1.1M.

3.03 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit and so anchors will be a minimum of 10 bolt diameters from edge of the base.
B. Use 3000 psi (20.7 MPa) , 28 day compressive strength concrete. Concrete materials, reinforcement and placement requirements are specified in Division 03 Section "(Cast-in-Place Concrete) (Cast-in-Place Concrete – Limited Applications)".
C. Anchor equipment to concrete base.
1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instruction and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor bolt manufacturer's written instructions.

3.04 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field painted surfaces.
1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

B. Touchup: Comply with requirements in Division 09 (painting sections) (Section "High Performance Coating") for cleaning and touchup painting of field welds, bolted connections and abraded areas of shop paint on miscellaneous metal.
C. Galvanized Surfaces: Clean welds, bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A 780.

END OF SECTION

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SECTION 26 05 33 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. The work under this section includes conduits, fittings, boxes, surface raceways, multi-outlet assemblies, and auxiliary gutters for electrical systems including wall and ceiling outlet boxes, floor boxes, and junction boxes.

1.02 SECTION INCLUDES

A. General
B. Manufacturers
C. Rigid Metal Conduit and Fittings
D. PVC Coated Rigid Metal Conduit
E. Intermediate Metal Conduit (IMC) and Fittings
F. Electrical Metallic Tubing (EMT) and Fittings
G. Flexible Metal Conduit (FMC) and Fittings
H. Liquidtight Flexible Metal Conduit (LFMC) and Fittings
I. Rigid Nonmetallic Conduit and Fittings
J. Conduit Supports
K. Multi Outlet Surface Raceway Assembly
L. Auxiliary Gutters (Wireways)
M. Outlet Boxes
N. Floor Boxes
O. Hinged Cover Enclosures
P. Cabinets
Q. Pull and Junction Boxes
R. Handholes and Boxes for Exterior Underground Wiring
S. Boxes for Fire Alarm Audio Visual Notification Appliances

1.03 RELATED WORK

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
B. Section 26 05 00 – Common Work Results for Electrical
C. Section 26 05 26 – Grounding and Bonding for Electrical Systems
D. Section 26 05 29 – Hangers and Supports for Electrical Systems
E. Section 26 27 02 – Equipment Wiring Systems
F. Section 26 27 26 – Wiring Devices
G. Division 27 – Communications
H. Division 28 – Electronic Safety and Security

1.04 SUBMITTALS

A. Surface Raceway System - submit product data and catalog sheets for all components.
B. Boxes - provide product data showing configurations, finishes, dimensions, and manufacturer's instructions.
C. Product data for conduit, wireways, fittings, floor boxes, hinged-cover enclosures or cabinets.

1.05 QUALITY ASSURANCE

A. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction and marked for intended use.

PART 2 – PRODUCTS

2.01 GENERAL

A. All steel fittings and conduit bodies shall be galvanized.
B. No cast metal, or split-gland type fittings permitted.
C. Mogul-type condulets larger than 2 inch (50 mm) not permitted except as approved or detailed.
D. All condulet covers must be fastened to the condulet body with screws and be of the same manufacture.
E. Wireways, gutters and c-condulets shall not be used in lieu of pull boxes and condulets.
F. All boxes shall be of sufficient size to provide free space for all conductors enclosed in the box and shall comply with NEC requirements.

2.02 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:
B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AFC Cable Systems, Inc.
2. Alflex Inc.
3. Allied Tube & Conduit; a Tyco International Ltd. Co
4. Anamet Electrical, Inc.; Anaconda Metal Hose
5. Armorcast Products Company
6. Arnco Corporation
7. CANTEX Inc
8. Carson Industries LLC
9. CDR Systems Corporation
10. CertainTeed Corp.; Pipe & Plastics Group
11. Christy Concrete Products
12. Condux International, Inc
13. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
14. EGS/Appleton Electric
15. ElecSYS, Inc
16. Electri-Flex Co.
17. Erickson Electrical Equipment Company
18. Hoffman
19. Hubbell Incorporated; Killark Electric Manufacturing Co. Division
20. Hubbell Incorporated; Quazite
21. Lamson & Sessions: Carlon Electrical Products
22. Manhattan/CDT/Cole-Flex
23. Maverick Tube Corporation
24. NewBasis
25. Nordic Fiberglass, Inc.
26. O-Z Gedney; a unit of General Signal
27. RACO; a Hubbell Company
28. Robroy Industries, Inc.; Enclosure Division
29. Scott Fetzer Co.; Adalet Division
30. Spring City Electrical Manufacturing Company
31. Synertech Moulded Products, Inc.; a division of Oldcastle Precast
32. Thomas & Betts Corporation
33. Wiremold ; Legrand
34. Wheatland Tube Company
35. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary

2.03 RIGID METAL CONDUIT AND FITTINGS

A. Conduit: Heavy wall, galvanized steel, schedule 40, threaded. ANSI C80.1
B. Fittings and Conduit Bodies: Use all steel threaded fittings and conduit bodies.

2.04 PVC COATED RIGID METAL CONDUIT

A. PVC Externally Coated Conduit: Rigid heavy wall, schedule 40, steel conduit with external 40 mil (0.1 mm) PVC coating. Conduit must be hot dipped galvanized inside and out including threads. The PVC coating bond to the galvanized steel conduit shall be stronger than the tensile strength of the coating itself.

B. Fittings and Conduit Bodies: Threaded type, material to match conduit. PVC coated fittings and couplings shall have specially formed sleeves to tightly seal to conduit PVC coating. The sleeves shall extend beyond the fitting or coupling a distance equal to the pipe outside steel diameter or two inches (50 mm) whichever is greater.

2.05 INTERMEDIATE METAL CONDUIT (IMC) AND FITTINGS

A. Conduit: Galvanized steel, threaded. ANSI C80.6

B. Fittings and Conduit Bodies: Use all steel threaded fittings and conduit bodies.

2.06 ELECTRICAL METALLIC TUBING (EMT) AND FITTINGS

A. Conduit: Steel, galvanized tubing. ANSI C80.3

B. Fittings: All steel, set screw, concrete tight. No push-on or indenter types permitted.

C. Conduit Bodies: All steel threaded conduit bodies.

2.07 FLEXIBLE METAL CONDUIT (FMC) AND FITTINGS

A. Conduit: steel, galvanized, spiral strip.

B. Fittings and Conduit Bodies: All steel, galvanized, or malleable iron (except as allowed in specification 26 51 13).

2.08 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC) AND FITTINGS

A. Conduit: flexible, steel, galvanized, spiral strip with an outer Liquidtight, nonmetallic, sunlight-resistant jacket.

B. Fittings and Conduit Bodies: ANSI/NEMA FB 1, compression type. There shall be a metallic cover/insert on the end of the conduit inside the connector housing to seal the cut conduit end.

2.09 RIGID NONMETALLIC CONDUIT AND FITTINGS

A. Conduit: Rigid non-metallic conduit, Schedule 40 PVC minimum, Listed, sunlight resistant, rated for 900 C conductors. Schedule 80 for locations exposed to physical damage or as required.

B. Fittings and Conduit Bodies: NEMA TC 2, Listed.

2.10 CONDUIT SUPPORTS

A. See section 26 05 29.

2.11 CONDUIT WATER SEALANT

A. Description: Conduit sealant used to prevent water from entering buildings via conduits.

B. Sealant shall seal conduits against water and gas intrusion, such as Polywater® FST™-250 Foam Duct Sealant, Raychem RDSS Rayflate Duct Sealing System, or approved alternate. Sealant shall be re-enterable, shall be compatible with the conduit and conductor types being used, and shall comply with NEC 225.27, 230.8, and 300.5(G).

C. Manufacturer names and catalog numbers are used to develop quality and performance requirements only. Products manufactured by others may be acceptable provided they meet or exceed the specifications.

2.12 MULTI-OUTLET SURFACE RACEWAY ASSEMBLY

A. Raceway shall have (2) wiring compartments with field removable cover(s). Multiple compartment raceway shall have an integral dividing barrier(s) isolating wiring compartments and provided with fittings that maintain the separation of compartments.

B. Covers must be removable with a standard straight blade screwdriver without marring. Raceways having two covers must allow each cover to be removed separately without allowing access into the compartment(s) enclosed by the other cover.

C. Raceway shall be manufactured of extruded #6063-T5 aluminum with a heavy etched Architectural Class II clear anodized finish. Raceway shall be factory cut to specified job requirements. Field cutting of raceway will not be permitted.
D. Wiring Devices
   1. Wiring devices and other connectors shall be factory installed, electrically wired, and covers labeled with (insert labeling choice) as identified in the building plans. Each receptacle shall be identified noting the panel number and circuit number from which it is fed. Receptacles rated higher than a NEMA 5-20R configuration shall also be provided with voltage, phase and amperage identified in the same manner. Grounding shall be maintained by means of factory installed NEC sized grounding conductor(s) and utilize insulation displacement connectors as required.
E. Communication Outlets
   1. Raceway covers: The raceway must be capable of containing, but not limited to, snap-in modular jacks (3-pair, 4-pair, 4-pair keyed and MMJ), coaxial and F-connectors and communication grommets. Wiring connections of these devices shall be completed at the jobsite by the appointed contractor.
F. Fittings
   1. The multioutlet assembly is to consist of factory assembled product with a full complement of fittings including, but not limited to, elbows (90º, internal and external), slide couplings for joining raceway sections, blank end caps for closing open ends of the raceway, and flat tees.
G. Communication Devices and Accessories
   1. The raceway manufacturer will provide a complete line of connectivity outlets and modular inserts for UTP (including Category 6), with face plates and bezels to facilitate mounting. A complete line of preprinted station and port identification labels, snap-in icon buttons as well as write-on station identification labels shall be available.

2.13 AUXILIARY GUTTERS (WIREWAYS)

A. Description: General purpose type wireway without knockouts.
B. Size: As required.
C. Cover: Screw applied cover
D. Finish: Rust inhibiting primer coat with gray enamel finish.

2.14 OUTLET BOXES

A. Sheet Metal Outlet Boxes and Device Boxes: galvanized steel, with stamped knockouts: NEMA 0S1.
B. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 3/8 inch male fixture studs where required.
C. Concrete Ceiling Boxes: Concrete type.
D. Cast Boxes: Cast ferroalloy, or aluminum type deep type, gasketed cover, threaded hubs: NEMA FB1.
E. Nonmetallic Outlet and Device Boxes: NEMA 0S2.
F. Small Sheet Metal Pull and Junction Boxes: NEMA 0S1.

2.15 FLOOR BOXES

A. Description: Floor Boxes for Installation in Cast-In-Place Concrete Floors: Fully-adjustable, stamped steel approved for use in on-grade floor applications. Boxes shall have the ability to accept a component that will allow the box to be installed in polished concrete or terrazzo floors. Boxes shall be painted with a bonded epoxy designed for use on metal reinforcement bar and related accessories before encapsulation in concrete.
B. Provide boxes with independent wiring compartments that allow for duplex receptacles, communication and/or audio/video services. Boxes shall have removable and relocatable dividers to permit custom configuration of compartments as well as permit feed to adjacent compartments. Boxes shall permit feed to compartments on the opposite side of the box through a tunnel.
C. The compartments shall be removable from the top of the floor box. Provide boxes with two (2) cable guides to organize and maintain the cables egress out of the box. The box shall contain the following number of knockouts
D. Provide boxes with sufficient capacity to house the devices indicated on the plans.
E. Type: Recessed, Concealed service.

F. Configuration:
   1. Type FB2 – Power, Data & AV: six gang floor box, on grade installation. Boxes shall be 14-5/8" L x 12-5/8" W x 3-3/4" H. Provide boxes with six (6) independent wiring compartments that allow for up to six (6) duplex receptacles, communication and/or audio/video services Provide mounting bracket and device plates for duplex receptacles in two of the 6 gangs. Provide mounting bracket and device plates for data in one of the gangs directly adjacent to the duplex receptacles. Provide mounting bracket and device plates for AV in three of the gangs opposite the duplex receptacles and data. Include divider to separate power and data compartments. Provide boxes with two (2) cable guides to organize and maintain the cables egress out of the box. The box shall contain the following number of knockouts: 10 1" trade size, six (6) 1-1/4" trade size, six (6) 3/4" trade size, and two (2) 2" trade size. Boxes shall be able to accept up to (6) six 2" trade size conduit feeds in the sides of the boxes and maintain a 4-inch deep concrete pour. Boxes shall be fully adjustable, accommodating a maximum 2-inch pre-concrete pour and a maximum 1/2" post-concrete pour adjustment. The box shall be able to accept standard size single gang (2-3/4" x 4-1/2"), double gang (2-3/4" x 4-1/2"), and triple gang (6-3/8" x 4-1/2") wall plates.
   2. Type FB1, FB3 – Power & Data: Four gang floor box, on grade installation. Boxes shall be 13-1/8" L x 13-1/8" W x 4-1/16" H. Provide mounting bracket and device plates for duplex receptacles in two of the 4 gangs. Provide mounting bracket and device plates for data in two of the 4 gangs. Include divider to separate power and data compartments. Provide boxes with two (2) cable guides to organize and maintain the cables egress out of the box. The box shall contain the following number of conduit knockouts: six 3/4-inch , ten (10) 1-inch, and eight (8) 1-1/4-inch. The box shall have two removable knockout plates that can be replaced with a 2-inch trade size conduit hub/ Boxes shall be fully adjustable, accommodating a maximum 2-inch pre-concrete pour and a maximum 1/2" post-concrete pour adjustment. The box shall include a series of device mounting plates that will accept both duplex power devices as well as plates that will accommodate Systimax workstation connectivity outlets. modular adapters, and other open system devices.

G. Floor Box Cover: Powder coat painted aluminum. Floor plates shall meet and exceed UL scrub water exclusion requirements for concrete, tile, carpet, and wood covered floors.

H. Covers shall be available with a carpet recess area or a solid lid. Secure the cover to the flange and enable cover to rotate greater than 180 degrees to reduce trip hazards and provide maximum amount of working space. Provide covers with spring-loaded self-closing slide egress doors to reduce egress opening when cables are exiting and reduce trip hazards. Provide two (2) egress openings per cover assembly.
   1. Type FB2 Cover - Round, Powder coat painted aluminum. Floor plates shall meet and exceed UL scrub water exclusion requirements for concrete, tile, carpet, and wood covered floors. Finished in powder-coated color as determined by architect on shop drawing submittals. Provide covers with spring-loaded self-closing slide egress doors to reduce egress opening when cables are exiting and reduce trip hazards. The cover shall be 9-1/4-inch in diameter
   2. Type FB1, FB3 Cover - Round, Powder coat painted aluminum. Floor plates shall meet and exceed UL scrub water exclusion requirements for concrete, tile, carpet, and wood covered floors. Finished in powder-coated color as determined by architect on shop drawing submittals. Provide covers with spring-loaded self-closing slide egress doors to reduce egress opening when cables are exiting and reduce trip hazards. The cover shall be 7-1/4-inch in diameter

2.16 HINGED COVER ENCLOSURES

A. NEMA 250, Type 1, with continuous hinge cover with flush latch, unless otherwise indicated.
   1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
   2. Nonmetallic Enclosures: Plastic, finished inside with radio frequency resistant paint.

2.17 CABINETS

A. NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
B. Hinged door in front cover with flush latch and concealed hinges.
C. Key latch to match panelboards.
D. Metal barriers to separate wiring of different systems and voltage.

E. Accessory feet where required for freestanding equipment.

2.18 PULL AND JUNCTION BOXES

A. Interior Sheet Metal Boxes: code gauge galvanized steel, screw covers, flanged and spot-welded joints and corners.
B. Interior Sheet Metal Boxes larger than 12 inches (300 mm) in any dimension shall have a hinged cover or a chain installed between box and cover.
C. Boxes 9 square feet and larger shall have hinged covers. Single covers shall not exceed 10 square feet.
D. Interior Sheet Metal Boxes connected to an exterior underground raceway shall have a drain hole located in the bottom of the box.
E. Exterior Boxes and Wet Location Installations: Type 4 and Type 6, flat-flanged, surface-mounted junction box, UL listed as rain-tight. PVC box and cover with ground flange, neoprene gasket, and stainless-steel cover screws.
F. Box extensions and adjacent boxes within 48 inches of each other are not allowed for the purpose of creating more wire capacity.
G. Junction boxes 6 inch-by-6 inch or larger size shall be without stamped knock-outs.
H. Wireways shall not be used in lieu of junction boxes.

2.19 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. Description: Comply with SCTE 77.
   1. Color of Frame and Cover: Gray, Green.
   2. Configuration: Units shall be designed for flush burial and have open, closed, integral closed bottom, unless otherwise indicated.
   3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure. Provide traffic rated covers.
   4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
   5. Cover Legend: Molded letting, ELECTRIC, TELEPHONE as indicated for each service. Insert legend.
   6. Conduit Entrance Provisions: Conduit terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
   7. Handhole 12 inches wide by 24 inches long and larger shall have inserts for cable racks and pulling in irons installed before concrete is poured.
B. Polymer Concrete Handholes and Boxes with Polymer Concrete Cover: Molded of sand and aggregate, bound together with polymer resin and reinforced with steel or fiberglass or a combination of the two.
C. Fiberglass Handholes and Boxes with Polymer Concrete Frame and Cover: Sheet molded, fiberglass reinforced, polyester resin enclosure joined to polymer concrete top ring or frame.
D. Fiberglass Handholes and Boxes: Molded of fiberglass reinforced polyester resin, with covers of polymer concrete, reinforced concrete, cast iron, hot dip galvanized steel diamond plate, fiberglass.

2.20 BOXES FOR FIRE ALARM AUDIO-VISUAL NOTIFICATION APPLIANCES

A. Recessed boxes for Fire Alarm audio, visual, and audio-visual notification appliances shall be galvanized steel sheet metal with stamped knockouts. Boxes shall be painted red.
B. For surface mounting, in locations approved by A/E through RFI process, use manufacturer supplied back boxes and trim plates, painted red or off white to match device color, and shall contain no visible conduit knock-outs. Mark each device with its circuit number.

PART 3 – EXECUTION

3.01 CONDUIT SIZING, ARRANGEMENT AND SUPPORT

A. EMT is permitted to be used in sizes 4 inch (100 mm) and smaller for power and low-voltage systems. See CONDUIT INSTALLATION SCHEDULE below for other limitations for EMT and other types of conduit.
B. Size power conductor raceways for conductor type installed. Conduit size shall be 1/2 inch (16 mm) minimum except all homerun conduits shall be 3/4 inch (21 mm), or as specified elsewhere. Caution:

Per the NEC, the allowable conductor ampacity is reduced when more than three current-carrying conductors are installed in a raceway. Contractor must take the NEC ampacity adjustment factors into account when sizing the raceway and wiring system.

C. Size communications and other low-voltage systems raceways as follows:
   1. Communications, including Outlet Box: 1 1/4 inch minimum unless noted otherwise on drawings. Conduit used for single device locations (e.g. Wireless Access Point, Video Surveillance Camera, and Wall mounted telephone) may be 3/4 inch minimum.
   2. Control, security, signal, video, and other low-voltage applications: 1 inch minimum.
   3. Fire Alarm: 1/2 inch minimum.
   4. Floor Box and Poke-Through Assemblies:
      a. Power: 3/4 inch minimum or as indicated on drawings.
      b. Low-voltage: 1 1/4 inch minimum or as indicated on drawings.
D. Provide one raceway from each communications outlet box to above accessible ceiling.
E. Arrange conduit to maintain 6'-8" clear headroom and present a neat appearance.
F. Route exposed conduit and conduit above accessible ceilings parallel and perpendicular to walls and adjacent piping.
G. Maintain minimum 6 inch (150 mm) clearance between conduit and piping. Maintain 12 inch (300 mm) clearance between conduit and heat sources such as flues, steam pipes, and heating appliances.
H. Arrange conduit supports to prevent distortion of alignment by wire pulling operations. Fasten conduit using galvanized pipe straps, conduit racks (lay-in adjustable hangers), clevis hangers, or bolted split stamped galvanized hangers.
I. Group conduit in parallel runs where practical and use conduit rack (lay-in adjustable hangers) constructed of steel channel with conduit straps or clamps. Provide space for 25 percent additional conduit.
J. Do not fasten conduit with wire or perforated pipe straps. Before conductors are pulled, remove all wire used for temporary conduit support during construction.
K. Support and fasten metal conduit at a maximum of 8 feet (2.4 m) on center.
L. Supports shall be independent of the installations of other trades, e.g. ceiling support wires, HVAC pipes, other conduits, etc., unless so approved or detailed.
M. Conceal all conduits except where noted on the drawings or approved by the Architect/Engineer. Contractor shall verify with Architect/Engineer all surface conduit installations except in mechanical rooms.
N. Changes in direction shall be made with symmetrical bends, cast steel boxes, stamped metal boxes or cast steel conduit bodies.
O. For indoor conduits, no continuous conduit run shall exceed 100 feet (30 meters) without a junction box.
P. All conduits installed in exposed areas shall be installed with a box offset before entering box.

3.02 CONDUIT INSTALLATION

A. Cut conduit square; de-burr cut ends.
B. Conduit shall not be fastened to the corrugated metal roof deck.
C. Bring conduit to the shoulder of fittings and couplings and fasten securely.
D. Use conduit hubs for fastening conduit to cast boxes. Use sealing locknuts or conduit hubs for fastening conduit to sheet metal boxes in damp or wet locations.
E. Threads cut in the field, and factory threads of conduit and nipples not coated with corrosion protection, shall be coated with an approved electrically conductive corrosion compound per NEC 300.6.
F. Corrosion inhibitor, when used in a food service environment, shall be approved for Food Service locations.
G. Terminate all conduit (except for terminations into conduit bodies) using conduit hubs, or connectors with one locknut, or utilize double locknuts (one each side of box wall).
H. Provide bushings for the ends of all conduit not terminated in a box. Refer to Section 26 05 26 – Grounding and Bonding for Electrical Systems for grounding bushing requirements.
I. Provide insulated bushings where raceways contain 4 AWG or larger conductors.
J. Communication and Low Voltage systems conduits shall terminate in horizontal plane.
K. Install no more than the equivalent of:

1. Three 90 degree bends between boxes for electrical systems.
2. Two 90 degree bends between boxes for communications and other low voltage systems. Note: Offsets shall be considered 90 degrees.
3. No single bend may exceed 90 degrees.

L. Use hydraulic one-shot conduit bender or factory elbows for bends in conduit larger than 2 inch (50 mm) size unless sweep elbows are required.
M. Bend conduit according to manufacturer's recommendations. Torches or open flame shall not be used to aid in bending of PVC conduit.
N. Use suitable conduit caps or other approved seals to protect installed conduit against entrance of dirt and moisture.
O. Provide 1/8 inch (3 mm) nylon pull string in empty conduit, except sleeves and nipples.
P. Install listed expansion-deflection fitting or other approved means shall be used where a raceway crosses a structural joint for expansion, contraction or deflection, used in buildings, bridges, parking garages or other structurers.
Q. Install expansion fitting in exterior PVC conduit runs per NEC table 352.44 utilizing a minimum temperature change of 120 degree F.
R. Avoid moisture traps where possible. Where moisture traps are unavoidable, provide junction boxes with drain holes at conduit low points.
S. Where conduit passes between areas of differing temperatures such as into or out of cool rooms, freezers, unheated and heated spaces, buildings, etc., provide condulet or box with duct seal or other means to prevent the passage of moisture and water vapor through the conduit.
T. Route conduit through roof openings for piping and ductwork where possible.
U. Where communication cabling is to be installed in conduit to the wiring hub (e.g. Telecom Room), multiple conduits may be consolidated into fewer, larger conduits. Capacity of shared conduits shall equal the capacity of the individual conduits unless otherwise noted.
V. Use NRTL listed metallic grounding clamps when terminating conduit to cable tray.
W. Ground and bond conduit under provisions of Section 26 05 26.
X. Conduit is not permitted in any slab topping.
Y. PVC conduit in concrete pole bases shall transition to galvanized rigid metal conduit 12 inches before it enters a concrete pole base. Inside the pole base, the elbow shall be galvanized rigid metal conduit. From the elbow, the conduit shall transition back to PVC as it continues up and out the top of the concrete pole base.
Z. PVC conduit shall transition to galvanized rigid metal conduit before it enters a foundation wall or up through a concrete floor.
AA. Identify conduit under provisions of Section 26 05 53.
BB. All conduit installed underground (exterior to building) shall be buried a minimum of 24 inches below finished grade, whether or not the conduit is concrete encased. Install warning tape 12" below finish grade over all buried conduits. Underground warning tape shall be detectable, 2" wide minimum, 5 mil thickness, containing a foil core. Tape color shall be red and labeled with the words "CAUTION-BURIED ELECTRIC LINE BELOW" as manufactured by Presco or similar.
CC. Conduits penetrating underground foundation walls: Individual conduits or each conduit as part of a ductbank penetrating underground foundation walls shall be sealed against water intrusion into the building.
DD. Clean PVC conduit with solvent, and dry before application of glue. The temperature rating of glue/cement shall match weather conditions. Apply full even coat of cement/glue to entire area that will be inserted into fitting. The entire installation shall meet manufacturer's recommendations.

3.03 CONDUIT INSTALLATION SCHEDULE

A. Conduit other than that specified below for specific applications shall not be used.
B. Underground Installations That Penetrate Foundation Walls: Rigid Metal conduit within five feet (1.5 m) of the foundation wall. Conduit may transition to PVC conduit five feet (1.5 m) from the foundation walls.
C. Underground Installations That Do Not Penetrate Foundation Walls: Rigid Metal conduit, or PVC conduit.

D. Underground Installations Emerging from Grade: Buried conduit emerging from grade shall be Rigid Metal conduit extending from the minimum cover distance of 24 inches below grade to the conduit termination point above grade.
E. Underground Installations Under Concrete Slab: Rigid Metal conduit or Schedule 40 PVC conduit.
F. Underground Installations Emerging through Concrete Slab: Rigid Metal conduit.
G. Concealed in Concrete Block Walls: Electrical Metallic Tubing, PVC conduit. Electrical Nonmetallic Tubing (ENT).
H. Exposed Outdoor Locations: Rigid Metal conduit, Intermediate Metal conduit.
I. Wet Interior Locations: Exposed: Rigid Metal conduit.
J. Concealed Dry Interior Locations: Rigid Metal conduit, Intermediate Metal conduit, Electrical Metallic Tubing.
K. Interior Building Grounding Electrode Conductor: Schedule 80 PVC.
L. Exposed Dry Interior Locations: Rigid Metal conduit, Intermediate Metal conduit, Electrical Metallic Tubing.
M. Motor and equipment connections: Liquidtight flexible metal conduit (LFMC) (all locations). Minimum length shall be one foot (300 mm); maximum length shall be three feet (900 mm). Conduit must be installed perpendicular to direction of equipment vibration to allow conduit to freely flex.
N. Light fixtures: Refer to specification section 26 51 13. Direct box or conduit connection for surface mounted and recessed fixtures. Flexible metal conduit from a J-box for recessed lay-in light fixtures. Conduit size shall be 3/8" (10 mm) minimum diameter and six foot (1.8 M) maximum length. Conduit length shall allow movement of fixture for maintenance purposes.

3.04 MULTI-OUTLET ASSEMBLY INSTALLATION

A. Use flat-head screws to fasten channel to surfaces every twenty-four (24) inches. Mount plumb and level.
B. Use suitable insulating bushings and inserts at connections to outlets and corner fittings.
C. Maintain grounding continuity between raceway components to provide a continuous grounding path under provisions of Section 26 05 26.
D. Fastener Option: Use clips and straps suitable for the purpose.

3.05 AUXILIARY GUTTERS (WIREWAYS) INSTALLATION

A. Bolt auxiliary gutter to wall using two-piece hangers or steel channels fastened to the wall or in self-supporting structure.
B. Gasket each joint in oil-tight gutter.
C. Mount rain-tight gutter in horizontal position only.
D. Maintain grounding continuity between raceway components to provide a continuous grounding path under provisions of Section 26 05 26.

3.06 COORDINATION OF BOX LOCATIONS

A. Provide electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and code compliance.
B. Electrical box locations shown on Contract Drawings are approximate unless dimensioned. Verify location of floor boxes and outlets in offices and work areas prior to rough-in.
C. No outlet, junction, or pull boxes shall be located where it will be obstructed by other equipment, piping, lockers, benches, counters, etc.
D. Boxes shall not be fastened to the metal roof deck.
E. It shall be the Contractor's responsibility to study drawings pertaining to other trades, to discuss location of outlets with workmen installing other piping and equipment and to fit all electrical outlets to job conditions.
F. In case of any question or argument over the location of an outlet, the Contractor shall refer the matter to the Architect/Engineer and install outlet as instructed by the Architect/Engineer.
G. The proper location of each outlet is considered a part of this contract and no additional compensation will be paid to the Contractor for moving outlets which were improperly located.
H. Locate and install boxes to allow access to them. Where installation is inaccessible, coordinate locations and provide 18 inch (450 mm) by 24 inch (600 mm) access doors.
I. Locate and install to maintain headroom and to present a neat appearance.

J. Install boxes to preserve fire resistance rating of partitions and other elements, using approved materials and methods.

3.07 OUTLET BOX INSTALLATION

A. Do not install boxes back-to-back in walls. Provide minimum 6 inch (150 mm) separation, except provide minimum 24 inch (600 mm) separation in acoustic-rated walls.
B. Power:
   1. Recessed (1/4" maximum) outlet boxes in masonry, concrete or tile construction shall be minimum 4 inch square, with device rings. Device covers shall be square-cut except rounded corner plaster rings are allowed in drywall applications. Angle cut plaster rings are not permitted. Coordinate masonry cutting to achieve neat openings for boxes.
C. Low Voltage:
   1. Recessed (1/4" maximum) outlet boxes in masonry, concrete or tile construction shall be minimum 4 11/16 inch square, 2-1/8" deep. Device covers shall be square-cut except rounded corner plaster rings are allowed in drywall applications. Angle cut plaster rings are not permitted. Coordinate masonry cutting to achieve neat openings for boxes.
D. Provide knockout closures for unused openings.
E. Support boxes independently of conduit except for cast boxes that are connected to two rigid metal conduits, both supported within 12 inches (300 mm) of box.
F. Use multiple-gang boxes where more than one device is mounted together; do not use sectional boxes. Provide non-metallic barriers to separate wiring of different voltage systems.
G. Install boxes in walls without damaging wall insulation.
H. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.
I. Ceiling outlets shall be 4 inch square, minimum 2-1/8 inch (54 mm) deep except that concrete boxes and plates will be approved where applicable. Position outlets to locate luminaires as shown on reflected ceiling plans.
J. In inaccessible ceiling areas, position outlets and junction boxes within 6 inches (150 mm) of recessed luminaire, to be accessible through luminaire ceiling opening.
K. Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioning to allow for surface finish thickness. Use stamped steel stud bridges for flush outlets in hollow stud wall, and adjustable steel channel fasteners for flush ceiling outlet boxes.
L. Align wall-mounted outlet boxes for switches, thermostats, and similar devices.
M. Provide cast ferroalloy or aluminum outlet boxes in exterior and wet locations.
N. Surface wall outlets shall be 4 inch (100 mm) square with raised covers for one and two gang requirements. For three gang or larger requirements, use gang boxes with non-overlapping covers.

3.08 FLOOR BOX INSTALLATION

A. Set boxes level and flush with finish flooring material.

3.09 PULL AND JUNCTION BOX INSTALLATION

A. Locate pull boxes and junction boxes above accessible ceilings, in unfinished areas or furnish and install Owner approved access panels in non-accessible ceilings where boxes are installed. All boxes are to be readily-accessible.
B. Support pull and junction boxes independent of conduit.

3.10 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from ½ inch (12.5 mm) sieve to No. 4 (4.75 mm) sieve and compacted to same density as adjacent undisturbed earth.
C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.
D. Install handholes and boxes with bottom below the frost line, insert depth of frost line below grade at project site, below grade.

E. Do not install in paved or concrete surfaces.
F. Field cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used and seal around penetrations after fittings are installed.

3.11 LOW VOLTAGE COMMUNICATIONS CONDUIT SYSTEM

A. Minimum size of conduit shall be 1" (one inch) for telecommunications (voice and data) including fiber optic installations, or where more than one type of cable or system is required to share a conduit.
B. Minimum size of conduit shall be 3/4", security access control and CCTV, nurse call and other low voltage systems such as alarms. Use 1/2-inch minimum flexible metallic conduit when installing raceway into door frames for security systems.
C. Conduit provided for overhead projectors, audio-visual floor boxes and other audio-visual locations shall be minimum 1-1/4" or as indicated on drawings.
D. Conduits shall be sized for a maximum 40% fill ratio.
E. Provide flush two-gang box with single gang plaster ring for each communications outlet or as noted on drawings.
F. Minimum size back box shall be 4" x 4" or double gang extra deep, except where noted differently. Provide 2" x 4" or single gang plaster ring to reduce opening for standard data outlet. Size of plaster ring may be adjusted (to 4" x 4") as required by outlet quantity.
G. Use only couplings and fittings designed specifically for type of conduit or raceway shown. Provide insulated bushings on each fitting and raceway end.
H. Provide raceways in walls from each back box stubbed into nearest accessible ceiling, corridor or access floor toward cable trays or toward Telecommunications Room. Ensure accessibility after other trades systems installation by extending raceway where necessary to an accessible location or near a cable tray. Where back boxes are installed in laboratories or other areas where future access may be difficult, provide conduit out to nearest accessible hallway.
I. Provide one conduit from each communications box. Horizontal conduit runs between wall boxes are not allowed.
J. In areas where cable tray or j-hooks must cross an inaccessible ceiling, provide 4" EMT conduit in lieu of cable tray or j-hooks. For instance, where cables are supported by one 4" j-hook run prior to encountering an inaccessible ceiling, provide (1) 4" conduit to span the inaccessible area. Where 4"x12" cable tray is used, provide (4) 4" conduits to span the inaccessible area.
K. Provide a 1/8 inch (3 mm) nylon pull string in each empty conduit longer than 60" to facilitate the installation of cables by the Owner or systems installers.
L. Provide insulated bushings on exposed or cut end of every conduit.
M. Conduit bends to be no less than 10 times the nominal outside diameter of conduit.
N. No conduit run shall be longer than 100 linear feet without a pull box.
O. No conduit run shall have more than two (2) 90 degree bends or total of 180 degrees of bend (including all offsets) without a pull box.
P. Pull boxes shall not be used in lieu of bends. Pull boxes shall be installed in straight section of conduit.
Q. Electrical LBs are not permitted unless manufactured for the use of communication cabling, having an internal bend radius appropriate for the cable size and application. Obtain engineer approval prior to installation.
R. Provide conduit sleeves through walls as required by communications cable or as indicated on project documents. Where 1 to 4 communications cables are required, provide a 1" sleeve. For 5-20 cables are required, provide 2" sleeve. For 20-50 cables, provide 3" sleeve. Above 50 cables provide 4" sleeve. Sleeves shall extend min. 2" beyond wall on each side with plastic grommet or bushing to protect cable from abrasion. Conduit fill of sleeves may exceed 40%. All sleeves shall be fire stopped with UL listed system.
S. Sleeves for cable access through walls or floors may not always be indicated on drawings. It is the contractor's responsibility to provide all sleeves in all locations as required by cable routing and as dictated by field conditions. Changes in a planned cable route during construction to reduce cable length or avoid obstructions shall not be a cause for change orders if additional sleeves are required.

T. It is the contractor's responsibility to provide sleeves and support for communications cables for the entirety of the cable route, whether in conduit, cable tray or approved j-hooks (no bridle rings). The contractor shall review the reflected ceiling plans to determine the most appropriate method of support for any given area. The project documents may or may not indicate a method of support. If hard ceilings must be crossed, the contractor shall provide conduit through (above) the inaccessible areas into accessible areas, regardless whether the project documents indicate another method (or no method) of support. No change orders will be accepted to alter a means of support (for instance, a change from cable tray to conduit to cross an inaccessible ceiling or from cable tray to sleeves to shorten a cable route).
U. Provide UL listed fire stop material between sleeve and wall. Provide UL listed fire stop system (material) or cap in unused conduit sleeves. Provide fire stop material in open portions of sleeves after communications cable has been installed. Fire stop system shall match or exceed the fire rating of the floor or wall which is penetrated by conduit and cable.
V. If the services of a separate fire stop contractor are not secured for the project, the electrical or communications contractor is responsible to provide all fire stop systems and materials in conduit and sleeves which are used by the contractor. This includes all unused conduits in the immediate vicinity whether they are used on this project or not, as long as they are intended for future use by similar low-voltage systems cabling along the same route.

END OF SECTION

SECTION 26 05 34
UNDERGROUND HDPE PATHWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The work under this section shall consist of providing all work, materials, labor, equipment, and supervision necessary to complete directional drilling, testing and other work, as required in these specifications, on the drawings, and as otherwise deemed necessary to complete the work.

1.02 SECTION INCLUDES

A. Conduit, Fittings and Splices
B. Tracer Wire
C. Drilling Fluid

1.03 RELATED WORK

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this section.
B. Section 02 32 00 – Geo Technical Investigation
C. Section 30 05 00 – Common Work Results for All Exterior Work
D. Section 31 25 00 – Erosion Control
E. Section 31 20 00 – Earthmoving
F. Section 31 23 16.13 – Trenching

1.04 SUBMITTALS

A. Submit shop drawings, catalog data, and manufacturer's technical data showing complete information on resin, pipe and fittings material composition, physical properties, and dimensions of the new pipe and fittings. Include manufacturer's recommendations for handling, storage, and repair of pipe and fittings if damaged. Furnish a certificate of compliance with specified pipe material requirements.
B. Provide written drilling plan outlining proposed equipment and construction methods, including the following:
   1. Detailed description of the procedures including construction techniques to provide the access required to install the pipeline
   2. Dimensioned drawings of any proposed changes in the pipe alignment or profile
   3. Literature describing in detail the drilling system to be used, including drill steering and locating system.
   4. Drawings showing: Layout of boring and receiving locations and associated equipment at each location, grade and alignment control system details, groundwater control provision of drilling equipment.
   5. Qualifications and experience record of the drilling superintendent and machine operators.
   6. Drilling fluid generation and management
C. Provide a directional drilling contingency plan that accounts for the following:
   1. Unforeseen obstructions that stop or delay the progress of drilling equipment
   2. Deviation from planned line and grade in excess of allowable tolerances
   3. Loss of drilling fluid
   4. Damage to other utilities
   5. Soil settlement or heaving
D. Provide written copies of quality assurance test results and reports performed by or for the contractor.
E. Within 48 hours of completing the pilot hole for each run of pipe, provide the log of the drilling operation and guidance system records documenting the line and grade of that pilot hole to the Construction Representative and the AE. Note the location of any utilities or difficult drilling that was encountered.

1.05 AS-BUILT DOCUMENTS

A. Provide printed record of actual horizontal and vertical location of installed pipe from borehole survey instrumentation in addition to marked up drawings.

PART 2 - PRODUCTS

2.01 CONDUIT, FITTINGS AND SPLICES

A. Conduit
   1. Schedule 80
   2. Continuous length smooth-wall HDPE conduit for electrical applications per ASTM F2160.
   3. Conduit shall be listed by a Nationally Recognized Testing Laboratory (NRTL).
   4. Color:
   5. Power – Black or Black with red stripes.
   6. Communications -- Orange

B. Fittings and Splices
   1. See PART 3.
   2. Couplings and Fittings shall be listed.

C. Marking
   1. Each length of pipe and each fitting shall be clearly and durably marked on their outer surface with their manufacturing details.
   2. Marking shall include Material Type, listing and the date of manufacture.
   3. Fittings shall be clearly and durably marked, including manufacturer's name or trademark, material type, class of pipe, listing and a date or code of manufacture..
   4. Spacing of labeling on pipe shall not exceed 10-feet.

2.02 TRACER WIRE

A. Tracer wire shall be #10 stainless steel wire with 45 mil HDPE jacket.
B. Alternately, tracer wire may be embedded in conduit wall.

2.03 DRILLING FLUID

A. ANSI/NSF 60 (Drinking Water Treatment Chemicals – Health Effects) certified bentonite-based drilling fluid.

PART 3 EXECUTION

3.01 GENERAL

A. Comply with the requirements of applicable specification sections for the utility line being installed.
B. Conduct any necessary field surveys, subsurface investigations and geotechnical investigations necessary to complete the work.
C. Locate all known utilities located adjacent to or crossing the utility line being installed. Excavate to expose utilities prior to initiating drilling and as required to verify applicable clearances. Clearance shall meet applicable code requirements and the requirements of the directional drilling process.
D. Locate and verify the clearance of known structures and foundations/footings located adjacent to or crossing the utility line being installed.

3.02 EXCAVATION, BACKFILL AND COMPACTION

A. Excavate insertion and receiving pits, and other access points as necessary to complete the work.

3.03 CONDUIT INSTALLATION

A. HDPE conduit may only be used in horizontal directional drilling applications. Installation must be in accordance with NFPA 70 National Electrical Code and be direct buried or encased in concrete.
B. HDPE shall not be routed such that it is exposed above grade.
C. Storage and handling of polyethylene pipe shall not result in damage to or deformation of the pipe. Protect polyethylene pipe from long-term exposure to temperature fluctuations and sunlight.
D. Prepare pipe on a relatively smooth surface, free of sharp rocks, sticks, or debris. Utilize cribbing, pipe stands, rollers, or other equipment as necessary to support the pipe.
E. Lift and move piping using ropes, slings, or straps. Do not use unprotected chains, hooks, or clamps to lift pipe.
F. When lifting and moving pipe, provide a minimum of two points of support. Do not support pipes at butt-fused joints.
G. Sections of pipes with cuts and gouges exceeding 10 percent of the pipe wall thickness or kinked sections shall be removed and rejoined at the Contractor's expense.
H. Plug all pipes at end of each workday. Provide a watertight plug to prevent entry of foreign materials into the pipe.

3.04 DRILLING

A. Drilling methods shall generally consist of drilling a pilot hole the length of the bore, followed by reaming and pullback of the pipeline. Ream borehole multiple times, as necessary. The equipment and methods used to complete the bore and install piping shall be determined by the Contractor, but subject to the Contract Documents.
B. The drill staging area shall be kept neat and orderly and disturb as little area as possible. The pipe staging area shall disturb as little area as needed to accommodate workers and equipment, and to string, fuse, and inspect the pipe.
C. Install all pulleys, rollers, bumpers, alignment control devices and other equipment required to support and protect the new pipe from damage during installation.
D. Utilize a drilling fluid cleaning/recycling system. Entry and exit pits shall be sized and constructed to completely contain drilling fluid.
E. Install boring to line and grade shown on drawings. Alignment shall be within tolerances specified in applicable utility specification sections.
F. Borehole survey instrumentation shall be used to monitor line and grade of the pilot hole. Contractor shall maintain records documenting the line and grade of the pilot hole.
G. Contractor shall notify the Project Representative upon completion of the pilot hole to observe alignment prior to reaming and pullback.

3.05 JOINING PIPE

A. Joints between lengths of conduit and between conduit and couplings, fittings and boxes shall be by an approved method using either Heat Fusion, Electrofusion or listed Mechanical Fittings. Glue and/or solvents are NOT approved.
B. Any joining method employed shall be in accordance with manufacturer recommendations.
C. The tensile strength at yield of the butt-fusion joints shall not be less than the pipe.

3.06 REAM AND PULLBACK

A. Back-ream Pilot hole reamed to accommodate pipe. Select reamer size and number of passes required.
B. Pull pipe back using swivel to prevent torsion of pipe.
C. Monitor tension forces on pipe during pullback. Do not exceed maximum stresses recommended by the pipe supplier.
D. Support pipeline during pullback operations. Provide supports/rollers in accordance with manufacturer's recommendations. Supports and rollers shall allow for free movement of the pipeline and prevent damage to the pipe.

E. Use a drilling fluid in conjunction with the installation of the pipe to fill the annular space around the installed pipeline. Contractor is responsible for determining the type of fluid to use.
F. Properly dispose all excess drilling fluid and slurry material recovered from the hole during drilling operations and displaced by the pipe during installation.
G. Unless otherwise noted on the drawings, terminate and cap carrier pipe 5' above the proposed ground surface.

3.07 TRACER WIRE

A. General
   1. Install Tracer Wire (unless embedded in conduit wall) during pullback operations.
   2. Terminate Tracer Wire at conduit end points and at all intermediate pull points in a fashion as to make it available for locating.
   3. Allow the manufacturer's recommended amount of time for cooling and relaxation due to tensile stressing prior to connecting pipe to adjacent pipe sections, fittings, or structures, or backfilling of the insertion pit. Provide sufficient excess length of new pipe at insertion pits to allow for cooling and relaxation.

B. Continuity Testing:
   1. Test continuity of the Tracer Wire using an ohmmeter prior to demobilizing.
   2. Tracer Wire Resistance shall be no greater than 105% of the specified unit resistance times installed length.
   3. Provide a written report describing equipment used, test methods, and detailed test results.
   4. In the event of a failed test, make all necessary repairs required to provide a tracer wire system that complies with the performance requirements of this section.

END OF SECTION

SECTION 26 05 36
CABLE TRAYS FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. The work under this section includes furnishing of all labor, material, supports and services to install a complete cable tray system as shown and or indicated on the drawings. The cable tray system is defined to include, but not limited to, straight sections of cable tray, bends, tees, elbows, drop-outs, supports and all other related accessories necessary for a complete installation.

1.02 SECTION INCLUDES

A. Manufacturers
B. Wire Mesh Basket Type Cable Tray

1.03 RELATED WORK

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
B. Section 26 05 00 – Common Work Results for Electrical
C. Section 26 05 26 – Grounding and Bonding for Electrical Equipment
D. Section 26 05 29 – Hangers and Supports for Electrical Systems.

1.04 SUBMITTALS

A. Shop Drawings: Indicate tray type, dimensions, support points, and finishes.
B. Product Data: Provide data for fittings and accessories. Provide data for fire stopping materials.
C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.05 REFERENCE STANDARDS

A. ANSI/NFPA 70 - National Electrical Code.
B. ASTM A 123 - Specification for Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip.
C. ASTM A 525 - General Requirements for Steel Sheet, Zinc-Coated Galvanized by the Hot-Dip Process.
D. ASTM A 607 -- Specification for Steel Sheet and Strip, Hot-rolled and Cold-Rolled, High Strength, Low-Alloy Columbium and/or Vanadium
E. ASTM B 633 -- Specification for Electro-deposited Coatings of Zinc on Iron and Steel
F. NEMA VE 1 - Metallic Cable Tray Systems.

1.06 QUALITY ASSURANCE

A. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction and marked for intended use.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:
B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Chalfant Manufacturing Company
   2. Cooper B-Line, Inc.
   3. Cope, T.J., Inc.; a subsidiary of Allied Tube & Conduit
   4. GS Metals Corp.; GLOBETRAY Products

5. MONO-SYSTEMS, Inc.
6. MPHusky
7. PW Industries
8. Cablofil-Legrand

2.02 WIRE MESH BASKET TYPE CABLE TRAY

A. Description: wire mesh basket type tray.
B. Material: Steel wire mesh. Mesh opening/spacing shall not exceed 2 x 4 inches.
C. Finish: Finish for carbon steel wire after welding and bending of mesh. Electrodeposited zinc plating. ASTM B633, Type III, SC-1.
D. Inside Width: As indicated on drawings.
E. Inside Depth: As indicated on drawings.
F. Inside Radius of Fittings: As indicated on drawings.
G. Provide manufacturer's standard clamps, hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, connectors and grounding straps. Provide splice plates with straight sections and fittings. Splice plate construction shall be designed to permit splice to be located at any point within the support span without diminishing cable tray rated loading capacity. Supports shall be UL classified as equipment grounding conductors. Trapeze hangers shall be supported by a minimum ½" diameter rods.
H. Tray system shall be steel, wire mesh type with a minimum useable loading depth one inch less than overall nominal tray depth.
I. Tray system shall not present sharp edges, burrs or projections injurious to wiring. Any burrs left from cutting or bending operations shall be filed smooth.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Install metallic cable tray in accordance with NEMA VE 1.
C. Remove burrs and sharp edges from cable trays.
D. The Contractor shall coordinate the installation of the cable tray with plumbing and HVAC Contractors so that clearance is maintained between the cable tray and other trades work. This clearance shall be a minimum of one (1) foot on both sides of the cable tray and eight (8) inches on top of the cable tray. If these conditions cannot be met, this Contractor shall notify the owner for clarification and direction before proceeding with installation.
E. No conduit shall be attached to the cable tray except for the conduits that terminate at the cable tray. Cable tray supports only, can be used to support conduit. Do not use more than 1/2 of the cable tray support for conduit support.
F. Support trays in accordance with Section 26 05 29. Provide supports at each connection point, at the end of each run, and at other points to maintain spacing between supports of 8 ft. (2.5 m) maximum.
G. Supports shall be constructed from formed shape channel members 1 5/8" x 1 5/8", pre-galvanized and 14 Ga. steel complete with nuts, bolts, washers, lock washers and tray clamps as required for a complete and finished installation.
H. All of the threaded rod used for the tray support shall be 3/8" diameter for 12" wide tray and 1/2" minimum for tray larger than 12" wide.
I. Bolts and nuts shall be installed in all holes of the cable tray splice plates per the manufacturer's instructions for installation. Make changes in direction and elevation using standard fittings.
J. Tray support shall be installed in a trapeze, wall angle, or center support configuration as shown on the plans, outlined in the spec and approved by the project engineer. Center support is allowed on 12" wide and less cable tray.
K. Submit a complete detailed sketch for approval of the actual proposed method of installation.
L. Maximum allowable deviation of the tray, from the level horizontal plane measured across the width of the tray, is one half of one inch (1/2"), with the tray loaded to capacity, as allowed by the NEC.

M. The approval of the installation method does not relieve this contractor from meeting the above deviation requirement. If additional support is needed, as determined by the project engineer, this contractor shall furnish and install the additional support at no additional cost to the State.
N. Use manufactured expansion fittings where required at the building expansion joints and as required by the manufacturer.
O. Nuts, bolts, washers, rod, etc. shall be plated.
P. Ground and bond cable tray under provisions of Section 26 05 26.
Q. Provide continuity between tray components.
R. Use anti-oxidant compound to prepare aluminum contact surfaces before assembly if required by the manufacturer.
S. Provide #4 AWG bare stranded copper equipment grounding conductor through entire length of tray. Bond equipment ground conductor to each component, each tray section, and connect to the main building equipment grounding conductor. Equipment grounding conductor is not required in telecommunications applications provided that the tray is U.L. Listed for grounding.
T. Bond cable tray to the telecommunication grounding bar or conductor in each equipment room (#4 AWG minimum).
U. Equipment grounding conductor connections to the horizontal tray shall be made using a U.L. listed mechanical connection. Sheet metal or TEK screws shall not be used for grounding. Split bolts may be used for connection to wire-basket type trays. Provide barriers to separate cables of different systems such as power, communications, data or processing.
V. On vertical runs, fasten cables to tray every 18 inches (457 mm). Install intermediate supports when cable weight exceeds the load carrying capacity of the tray rungs.
W. In existing construction, remove inactive or dead cables from cable tray.
X. All single and multi-conductor cables shall be fastened to tray at intervals not to exceed four feet (4').
Y. Conduit connections to the tray shall be made with an U.L. approved clamp, manufactured specifically for the purpose.
Z. Do not install cable tray below re-heat coils, traps, etc. In those areas that have no option furnish and install a manufacturer approved cover extending 12” on either side.
AA. Where cable tray is to penetrate a fire rated wall or floor, the following installation method shall be used by this contractor:
    1. Stop the tray at the penetration and fasten the tray end to the wall/floor.
    2. For every 6" of tray width, furnish and install a 4" rigid galvanized nipple, threaded at both ends, through the penetration extending 4" beyond both sides and supported per section 26 05 29.
    3. Provide a fiber or plastic bushing on one end and ground bushing on other.
    4. Bond each grounding bushing to the equipment grounding conductor with a minimum # 4 stranded copper wire using an U.L. listed connector.
    5. Completely seal around conduits with U.L. listed fire rated assembly appropriate for penetration.
    6. Completely seal the conduits that have conductors and cables passing through, with a U.L. approved fire rated sealant.
    7. Close off unused conduits with a 14 Ga. steel penny held in place by the above required bushings.
    8. The Contractor may run cable tray through fire rated wall or floor provided opening is sealed with fire putty and/or pillows according to manufacturer’s recommendations. The entire assembly must be UL approved and meet fire code requirement.

3.02 PROTECTION

A. Protect installed cable trays.
    1. Repair damage to galvanized finishes with zinc rich paint recommended by cable tray manufacturer.
    2. Repair damage to PVC or paint finishes with matching touchup coating recommended by cable tray manufacturer.
    3. Install temporary protection for cables in open trays to protect exposed cables from falling objects or debris during construction. Temporary protection for cables and cable tray can be constructed of wood or metal materials until the risk of damage is over.

END OF SECTION

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SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. The work under this section includes the products and execution requirements relating to labeling of conduit, power, lighting, general wiring, signal, fire alarm, and telecommunications wire and cabling. Further, this section includes labeling of all terminations and related sub-systems, including but not limited to nameplates, stenciling, wire and cable marker labeling of all backbone fiber optic (inter-building, tie & riser) cables, terminating equipment and labeling of inner duct (fiber optic).

1.02 SECTION INCLUDES

A. Manufacturers
B. Identification Materials
C. Power Raceway Identification Materials
D. Armored and Metal-clad Cable Identification Materials
E. Power and Control Cable Identification Materials
F. Conductor Identification Materials
G. Underground-Line Warning Tape
H. Equipment Identification Labels
I. Cable Ties
J. Miscellaneous Identification Products

1.03 RELATED WORK

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.
B. Section 26 05 00 – Common Work Results for Electrical
C. Section 26 05 19 – Low-Voltage Electrical Power Conductors and Cables
D. Section 26 05 33 - Raceway and Boxes for Electrical Systems
E. Section 26 24 16 – Panelboards
F. Section 26 27 26 – Wiring Devices
G. Section 26 27 28 – Disconnect Switches

1.04 SUBMITTALS

A. Include product data for each electrical identification product indicated.
B. Include schedule for nameplates and stenciling.
C. Prior to installation, the Contractor shall provide samples of all label types planned for the project. These samples shall include examples of the lettering to be used. Samples shall be mounted on 8 1/2" x 11" sheets annotated, explaining their purposed use.

1.05 QUALITY ASSURANCE

A. Comply with ANSI A13.1.
B. Comply with NFPA 70.
C. Comply with 29 CFS 1910.144 and 29 CFR 1910.145.
D. Comply with ANSI Z535.4 for safety signs and labels.
E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers shall comply with UL 969.

1.06 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
C. Coordinate installation of identifying devices with location of access panels and doors.
D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Pipe/conduit identification
      a. Pipe maker by Briman Industries, Inc.
      b. Seton
      c. Brady
      d. Emedco
      e. Graphic Products
      f. Panduit
      g. Thomas & Betts
   2. Conductor & Warning Identification
      a. 3M
      b. Panduit
      c. Thomas & Betts
      d. Brady

2.02 IDENTIFICATION MATERIALS

A. General:
   1. Labels: All labels shall be permanent, and machine generated. NO HANDWRITTEN OR NON-PERMANENT LABELS ARE ALLOWED. Exception: back side of device plates and junction boxes may use handwritten, legible labeling on box covers, unless specifically prohibited by other specification sections.
   2. Cable label size shall be appropriate for the conductor or cable size(s), outlet faceplate layout and patch panel design. All labels shall be self-laminating, white/transparent vinyl and be wrapped around the cable or sheath. Labels for power conductors (600V and lower) shall be cloth-type. Flag type labels are not allowed. The labels shall be of adequate size to accommodate the circumference of the cable being labeled and properly self-laminate over the full extent of the printed area of the label.
   3. Nameplates: Engraved three-layer laminated plastic, black letters on a white background. Emergency system (level 1 and level 2) shall use white letters on red background.
   4. Tape (phase identification only): Scotch #35 tape in appropriate colors for system voltage and phase.
   5. Adhesive type labels not permitted except for phase and wire identification. Machine generated adhesive labels shall be permitted for device plates, 4-11/16” and smaller junction boxes, Fire alarm and control devices.

2.03 POWER RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
B. Colors for Raceways Carrying Circuits at 600 V or Less:
   1. Black letters on an orange field.
C. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistance coating and matching wraparound adhesive tape for securing ends of legend label.
D. Marker Plates for Raceway Carrying Circuits at 600V or Less. Nylon, Preprinted, flexible label secured to raceway with nylon cable ties. Align long dimension of marker plate with conduit direction. Panduit Marker Plates or similar

E. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
F. Snap-Around, Color Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
G. Tape and Stencil for Raceways Carrying Circuits More than 600 V: 4-inch (100 mm) wide black stripes on 10-inch (250 mm) centers diagonally over orange background that extends full length of raceway or duct and is 12 inches (300 mm) wide. Stop stripes at legends.
H. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch (50 by 50 by 1.3 mm), with stamped legend, punched for use with self-locking cable tie fastener.

2.04 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
C. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
D. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
E. Color coding shall be as noted in Section 26 05 19.

2.05 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.
B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
C. Snap-Around Labels: Slit, pretensioned, flexible, solid-colored acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identified and to stay in place by gripping action.
D. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
E. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
F. Color coding shall be as noted in Section 26 05 19.

2.06 UNDERGROUND-LINE WARNING TAPE

A. Tape:
   1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical [and communications] utility lines.
   2. Printing on tape shall be permanent and shall not be damaged by burial operations.
   3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.
B. Color and Printing:
   1. Comply with ANSI Z535.1 through ANSI Z535.5.
   2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.
   3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.

2.07 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 28 CFR 1910.145.
B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Baked-Enamel Warning Signs:
   1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
   2. ¼ inch (6.4 mm) grommets in corners for mounting.
   3. Nominal size, 7 by 10 inches (180 by 250 mm).
D. Warning label and sign shall include, but are not limited to, the following legends:
   1. Multiple Power Source Warning: "DANGER ELECTRICAL SHOCK HAZARD – EQUIPMENT HAS MULTIPLE POWER SOURCES."
   2. Workspace Clearance Warning: "WARNING – OSHA REGULATION – AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

2.08 CABLE TIES

A. General –Purpose Cable Ties: Fungus insert, self-extinguishing, one-piece, self-locking, Type 6/6 nylon.
   1. Minimum Width: 3/16 inch (5 mm).
   2. Tensile Strength at 73° F (23° C), According to ASTM D638: 12,000 psi (82.7 MPa).
   3. Temperature Range: Minus 50 to plus 185° F. (Minus 50 to plus 85° C).
   4. Color: Black except where used for color-coding.
B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one-piece, self-locking, Type 6/6 nylon.
   1. Minimum Width: 3/16 inch (5 mm).
   2. Tensile Strength at 73° F (23° C), According to ASTM D638: 12,000 psi (82.7 MPa).
   3. Temperature Range: Minus 40 to plus 185° F (Minus 40 to plus 85° C).
   4. Color: Black.
C. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one-piece, self-locking.
   1. Minimum Width: 3/16 inch (5 mm).
   2. Tensile Strength at 73° F(23 ° C), According to ASTM D638: 7,000 psi (48.2 MPa)
   3. UL 94 Flame Rating: 94V-0.
   4. Temperature Range: Minus 50 to plus 284° F (Minus 46 to plus 140° C).
   5. Color: Black.

2.09 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in Division 09 painting sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).
B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 – EXECUTION

3.01 GENERAL

A. Identification legend, colors of labels and color of raceway shall match facility standards. When no standards established the following systems shall be used.
B. Where mixed voltages are used in one building (e.g. 4160 volt, 480 volt, 208 volt) each switch, switchboard, junction box, equipment, etc., on each system must be labeled for voltage in addition to other requirements listed herein.
C. All branch circuit and power panels must be identified with the same identification legend used in circuit directory in main distribution center.
D. Clean all surfaces before attaching labels with the label manufacturer's recommended cleaning agent.
E. Install all labels firmly as recommended by the label manufacturer.
F. Labels shall be installed plumb and neatly on all equipment.
G. Install nameplates parallel to equipment lines.
H. Secure nameplates to equipment fronts using screws, rivets or manufacturer approved adhesive or cement.
I. Embossed tape will not be permitted for any application.

3.02 INSTALLATION

A. Verify identity of each item before installing identification products.
B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
C. Apply identification devices to surfaces that require finish after completing of finish work.
D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
F. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.
G. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
H. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
   1. Outdoors: UV-stabilized nylon.
   2. In Spaces Handling Environmental Air: Plenum rated.
I. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches (400 mm) overall.
J. Painted Identification: Comply with requirements in Division 09 painting Sections for surface preparation and paint application.

3.03 IDENTIFICATION SCHEDULE

A. Accessible Raceway, 600 V or Less, for Service, Feeder, and Branch Circuits More than 30 A, and 120 V to ground: Install with self-adhesive vinyl tape applied in bands identifying circuit numbers and source panel designation. Install labels at 10-foot intervals along path of raceway.
B. Raceway for Service, Feeder, and Branch Circuits protruding concrete floor. Install with nylon marker plate identifying circuit numbers and source panel designation contained in raceway. Install within 12” of floor penetration.
C. Identify the covers of each junction and pullbox containing branch circuits 30A or less and 120V or 277V to ground with self-adhesive vinyl labels identifying circuit numbers and source panel designation.
D. Identify the covers of each junction and pullbox containing feeders with engraved nameplate.
E. Conductors to be Extended in the Future: Attach marker tape to conductors and list source.
F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
   1. Identify conductors, cables and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
   2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
   3. Coordinate identification with Project Drawings, manufacturer’s wiring diagrams, and the Operation and Maintenance Manual.
G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optic fiber cable.
   1. Limit use of underground-line warning tape to direct-buried cables.
   2. Install underground-line warning tape for both direct-buried cables and cables in raceway.
H. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
I. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels Baked-enamel warning signs.
   1. Comply with 29 CFR 1910.145.

2. Identify system voltage with black letters on an orange background.
3. Apply to exterior of door, cover, or other access.
4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
   a. Controls with external control power connections.

J. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

K. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8 inch (10-mm) high letters for emergency instructions at equipment used for power transfer.

L. Provide a sign at the service-entrance equipment indicating type and location of on-site emergency power sources and on-site legally required standby power sources, per NEC 700.7 and NEC 701.7.

3.04 RACEWAY IDENTIFICATION

A. The following raceways shall be identified using factory colored conduit.

System	Color(s)
Fire Alarm	Red
Temperature Controls	Blue

3.05 JUNCTION AND PULLBOX IDENTIFICATION

A. The following junction and pullboxes shall be identified utilizing spray-painted covers:

System	Color(s)
Power – 208Y/120V	White
Fire Alarm	Red
Temperature Control	Blue

B. Provide circuit numbers, and source panel designations for power wiring. Other system shall be identified as shown on details or approved shop drawings. Temperature control shall identify the source.

3.06 POWER AND CONTROL WIRE IDENTIFICATION

A. Provide wire markers on each conductor in panelboard gutters, pull boxes, outlet and junction boxes, and at load connection. Identify with branch circuit or feeder number for power and lighting circuits, and with control wire number as indicated on schematic and interconnection diagrams or equipment manufacturer's shop drawings for control wiring.

B. All wiring shall be labeled within 2 to 4 inches of terminations. Each end of a wire or cable shall be labeled as soon as it is terminated including wiring used for temporary purposes.

3.07 WIRING DEVICE IDENTIFICATION

A. Wall switches, receptacles, occupancy sensors, wall dimmers, device plates and box covers, shall be identified with circuit numbers and source. Identifications should be made on face of device covers, unless directed otherwise. Use machine-generated labels.

3.08 NAMEPLATE ENGRAVING

A. Refer to drawing details for custom nameplate to be applied to the following types of equipment:
   1. Switchboards & Panelboards: 1 inch text; identify equipment designation. 1/2 inch text; identify voltage rating, source and room location of the source.
   2. Transformers: 1 inch text; identify equipment designation. 1/2 inch text; identify primary and secondary voltages, primary source, and secondary load and location.
   3. Enclosed Circuit Breakers, Motor Control Equipment and Disconnects: 1 inch text; identify equipment designation. 1/2 inch text; identify voltage rating, source and room location of source.
   4. Lighting Contactors: 1 inch text; identify equipment designation. 1/2 inch text; identify voltage rating, source and room location of the source.

5. Hinged Cover Enclosures and Cabinets, Junction boxes: 1 inch text; identify system source(s) and load(s) served.
6. Photovoltaic Equipment: Refer to drawing details.

END OF SECTION

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SECTION 26 05 73
SHORT CIRCUIT/COORDINATION STUDY AND ARC FLASH HAZARD STUDY

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. The electrical contractor shall retain the services of an independent third party firm to perform a short circuit/coordination study and arc flash hazard study as described herein.
B. The preliminary studies shall be submitted to the Design Engineer prior to receiving final approval of the distribution equipment shop drawings and/or prior to release of equipment for manufacture. If formal completion of the studies may cause delay in equipment manufacture, approval from the Engineer may be obtained for a preliminary submittal of sufficient study data to ensure that the selection of device ratings and characteristics will be satisfactory. The preliminary studies shall be revised and final study resubmitted following installation of conductors and equipment.
C. The studies shall include all portions of the electrical distribution system from the normal power source or sources, and emergency / standby sources, down to and including the smallest circuit breaker in the distribution system (for short circuit calculations). Normal system connections and those which result in maximum fault conditions shall be adequately covered in the study.
D. The firm should be currently involved in high- and low-voltage power system evaluation. The study shall be performed, stamped and signed by a registered professional engineer in the State of Wisconsin. Credentials of the individual(s) performing the study and background of the firm shall be submitted to the Design Engineer for approval prior to start of the work. A minimum of five (5) years' experience in power system analysis is required for the individual in charge of the project.
E. The firm performing the study should demonstrate capability and experience to provide assistance during start up as required.
F. The study and assessment shall be performed based on SKM's systems analysis and PowerTool for Windows (PTW) software program.

1.02 SECTION INCLUDES

A. Short Circuit and Coordination Study
B. Field Settings
C. Arc Flash Hazard Study

1.03 RELATED WORK

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
B. Section 26 24 16 – Panelboards
C. Section 26 27 28 – Disconnect Switches
D. Section 26 28 16 – Enclosed Switches and Circuit Breakers

1.04 SUBMITTALS

A. THIRD PARTY QUALIFICATIONS
   1. Submit qualifications of individual(s) who will perform the work to Design Engineer for approval prior to commencement of the studies. Study shall be sealed by WI professional engineer.
B. DRAFT REPORT
   1. Submit a draft of the preliminary study to Design Engineer for review prior to equipment shop drawings submittals. Make all additions or changes as required by the reviewer.
C. FINAL STUDY REPORT
   1. Provide studies in conjunction with equipment submittals and after installation of conductors and equipment to verify equipment ratings required.
   2. The results of the power system study shall be summarized in a final report. Six (6) bound copies of the final report shall be submitted. Provide two (2) copies in PDF format of the study, so that it can be more easily stored and shared. Also, provide 2 copies (on CD) of the report in MS word, and 2 copies (on CD) of the one-line diagram in CAD format.
      a. The report shall include the following sections:

b. Overview/executive summary/recommendations
c. Short Circuit Study
   1) SC-1 Purpose
   2) SC-2 Explanation of Data
   3) SC-3 Assumptions
   4) SC-4 Analysis of Results
   5) SC-5 Recommendations
   6) SC-6 DAPPER Fault Analysis Input Report
d. Protective Device Coordination Study
   1) PDC-1 Purpose
   2) PDC-2 Explanation of Data
   3) PDC-3 Assumptions
   4) PDC-4 Analysis of Results
   5) PDC-5 Recommendations (Including NEC 700-27 Requirement)
   6) PDC-6 CAPTOR Results
   7) PDC-7 Protective device settings table
   8) PDC-8 Time-Current Coordination Graphs
e. Arc Flash Study
   1) ARC-1 Purpose
   2) ARC-2 Explanation of Data
   3) ARC-3 Assumptions
   4) ARC-4 Analysis of Results
   5) ARC-5 Recommendations
   6) ARC-6 SKM Arc Flash Evaluation Report
f. Prioritized Recommendations and Conclusions
g. Appendices
   1) APP-1 DAPPER One-line Diagrams
   2) APP-2 AutoCAD One-line Diagrams
   3) APP-3 SKM Protective Device Summaries
   4) APP-4 Reference Data
   5) APP-5 Sample Work Permit Form
   6) APP-6 Copy of Warning Labels, including study date

D. The above sections shall include the following items in detail:
   1. Obtain available fault current from the local utility company.
   2. Short circuit studies shall evaluate the available fault current at each bus (each change of impedance), including all three-phase motors.
   3. Coordination study shall provide recommendations for relay settings, breaker settings, and motor protection settings.
   4. Coordination study shall provide recommendations for improving coordination with proper upgrading of protective device type or frame size and/or load distribution, as well as ground fault requirements.
   5. Arc flash values for two normal cases to define the highest values (low short circuit and high short circuit).
   6. Arc flash values for two maintenance cases, which define the arc flash values available at the equipment that would be available if the instantaneous trip of the upstream circuit breaker is set at a minimum value. This is recommended if someone has to work on live equipment.
   7. Arch Flash Hazard Methodology Analysis Results and Recommendations shall include the details of the incident energy and flash protection boundary calculations, along with Arc Flash boundary distances, working distances, Incident Energy levels and Personal Protection Equipment levels. Arc Flash labeling section sowing types of labels to be provided. Section shall contain descriptive information as well as typical label images.
   8. IEEE standard one-line diagram with equipment evaluation and circuit breaker setting forms that clearly define the system data and are easy to interpret. One-line system diagram that shall be computer generated and shall clearly identify individual equipment buses, bus numbers used in the short-circuit analysis, cable and bus connections between the equipment, calculated maximum short-circuit current at each bus location, device numbers used in the time-current coordination analysis, and other information pertinent to the computer analysis.

9. Recommendations to reduce the arc flash incident energy in all areas that require Class 2 and higher PPE.
10. Prioritized report summarizing all recommendations from this study. This shall include observed NEC code violations and their corrective action.
11. The contractor shall provide a one-line diagram that meets IEEE/ANSI standard 141, mounted on 24" x 36" (minimum) Styrofoam backboard. This one-line diagram shall be mounted in each electrical room.

1.05 REFERENCE STANDARDS

A. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
   1. IEEE 141 – Recommended Practice for Electric Power Distribution and Coordination of Industrial and Commercial Power Systems
   2. IEEE 242 – Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
   3. IEEE 399 – Recommended Practice for Industrial and Commercial Power System Analysis
   4. IEEE 241 – Recommended Practice for Electric Power Systems in Commercial Buildings
   5. IEEE 1015 – Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems.
   6. IEEE 1584 -Guide for Performing Arc-Flash Hazard Calculations
B. American National Standards Institute (ANSI):
   1. ANSI C57.12.00 – Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
   2. ANSI C37.13 – Standard for Low Voltage AC Power Circuit Breakers Used in Enclosures
   3. ANSI C37.010 – Standard Application Guide for AC High Voltage Circuit Breakers Rated on a Symmetrical Current Basis
   4. ANSI C 37.41 – Standard Design Tests for High Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches and Accessories.
C. The National Fire Protection Association (NFPA)
   1. NFPA 70 -National Electrical Code, latest edition
   2. NFPA 70E – Standard for Electrical Safety in the Workplace

1.06 QUALITY ASSURANCE

A. Software algorithms shall comply with requirements of standards and guides specified in this section. Manual calculations are not acceptable.
B. Coordination Study Specialist Qualifications: An entity experienced in the application of computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.
   1. Professional engineer, licensed in the state where project is located, shall be responsible for the study. All elements of the study shall be performed under the direct supervision and control of engineer.
C. Comply with IEEE 242 for short circuit currents and coordination time intervals.
D. Comply with IEEE 399 for general study procedures.

1.07 DATA COLLECTION FOR THE STUDY

A. The contractor shall provide the required data for preparation of the studies. The engineer performing the system studies shall furnish the contractor with a listing of the required data immediately after award of the contract.
B. The contractor shall expedite collection of the data to assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to release of the equipment for manufacture.
C. Source combination may include present and future motors and generators.
D. Load data utilized may include existing and proposed loads obtained from Contract Documents provided by Owner, or Contractor.
E. If applicable, include fault contribution of existing motors in the study. The contractor shall obtain required existing equipment data, if necessary, to satisfy the study requirements.

PART 2 – PRODUCTS

2.01 NOT USED

PART 3 – EXECUTION

3.01 SHORT CIRCUIT AND COORDINATION STUDY

A. Short circuit, coordination, and arc flash hazard studies shall be performed using SKM Dapper, Captor and PowerTool for Windows software packages. In the short circuit study, provide calculation methods and assumptions, the base per unit quantities selected, one-line diagrams, source impedance data including power company system characteristics, typical calculations, and recommendations. Calculate short circuit interrupting and momentary (when applicable) duties for an assumed 3-phase bolted fault at each supply switchgear lineup, unit substation primary and secondary terminals, low voltage switchgear lineup, switchboard, motor control center, distribution panelboard, pertinent branch circuit panelboard, and other significant locations throughout the system. Provide a ground fault current study for the same system areas, including the associated zero sequence impedance data. Include in tabulations fault impedance, X to R ratios, asymmetry factors, motor contribution, short circuit KVA, and symmetrical and asymmetrical fault currents.

B. In the protective device coordination study, provide time-current curves graphically indicating the coordination proposed for the system, centered on conventional, full-size, log-log forms. Include with each curve sheet a complete title and one-line diagram with legend identifying the specific portion of the system covered by that particular curve sheet. Include a detailed description of each protective device identifying its type, function, manufacturer, and time-current characteristics. Tabulate recommended device tap, time dial, pickup, instantaneous, and time delay settings.

C. Include on the time-curve sheets power company relay and fuse characteristics, system medium-voltage equipment relay and fuse characteristics, low-voltage equipment circuit breaker trip device characteristics, pertinent transformer characteristics, pertinent transformer characteristics, pertinent motor and generator characteristics, and characteristics of other system load protective devices. Include at least all devices down to largest branch circuit and largest feeder circuit breaker in each motor control center, and main breaker in branch panelboards.

D. Include all adjustable settings for ground fault protective devices. Include manufacturing tolerance and damage bands in plotted fuse characteristics. Show transformer full load and 150, 400, or 600 percent currents, transformer magnetizing inrush, ANSI transformer withstand parameters, and significant symmetrical and asymmetrical fault currents. Terminate device characteristic curves at a point reflecting the maximum symmetrical or asymmetrical fault current to which the device is exposed.

E. Select each primary protective device required for a delta-wye connected transformer so that its characteristic or operating band is within the transformer characteristics, including a point equal to 58 percent of the ANSI withstand point to provide secondary line-to-ground fault protection. Where the primary device characteristic is not within the transformer characteristics, show a transformer damage curve. Separate transformer primary protective device characteristic curves from associated secondary device characteristics by a 16 percent current margin to provide proper coordination and protection in the event of secondary line-to-line faults. Separate medium-voltage relay characteristic curves from curves for other devices by at least a 0.4-second time margin.

F. Include complete fault calculations as specified herein for each proposed and ultimate source combination. Note that source combinations may include present and future supply circuits, large motors, or generators as noted on drawing one-lines.

G. Utilize equipment load data for the study obtained by the Contractor from contract documents, including contract addendums issued prior to bid openings.

H. Include fault contribution of all motors in the study. Notify the Engineer in writing of circuit protective devices not property rated for fault conditions.

I. Provide settings for the chiller motor starters or obtain from the mechanical contractor, include in the study package, and comment.

J. When an emergency generator is provided, include phase and ground coordination of the generator protective devices, to meet NEC 700.27 requirements. Show the generator decrement curve and damage curve along with the operating characteristic of the protective devices. Obtain the information from the

generator manufacturer and include the generator actual impedance value, time constants and current boost data in the study. Do not use typical values for the generator.

K. Evaluate proper operation of the ground relays in 4-wire distributions with more than one main service circuit breaker, or when generators are provided, and discuss the neutral grounds and ground fault current flows during a neutral to ground fault.

L. For motor control circuits, show the MCC full-load current plus symmetrical and asymmetrical of the largest motor starting current to ensure protective devices will not trip major or group operation.

3.02 FIELD SETTINGS AND ADJUSTMENT

A. The Contractor shall perform field adjustments of the protective devices as required to place the equipment in final operating condition. The settings shall be in accordance with the approved short circuit study, protective device coordination study and arc flash hazard study.

B. Necessary field settings of devices and adjustments and minor modifications to equipment to accomplish conformance with the approved short circuit and protective device coordination study shall be carried out by the Contractor at no additional cost to the owner.

3.03 ARC FLASH HAZARD STUDY

A. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E-2009, Annex D. The arc flash hazard analysis shall be performed in conjunction with the short-circuit analysis (Section 2.03) and the protective device time-current coordination analysis (Section 2.04)

B. The flash protection boundary and the incident energy shall be calculated at significant locations in the electrical distribution system (switchboards, switchgear, motor-control centers, panelboards, busway and splitters) where work could be performed on energized parts.

C. Circuits 240V or less fed by single transformer rated less than 125 kVA may be omitted from the computer model and will be assumed to have a hazard risk category 0 per NFPA 70E.

D. Working distances shall be based on IEEE 1584. The calculated arc flash protection boundary shall be determined using those working distances.

E. When appropriate, short circuit calculations and clearing times of phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Ground overcurrent relays should not be taken into consideration when determining clearing time when performing incident energy calculations.

F. The short-circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared and the greatest incident energy must be uniquely reported for each equipment location in a single table. Calculations must be performed to represent the maximum and minimum contributions of fault current magnitude for normal and emergency operating conditions. The minimum calculation will assume that the utility contribution is at a minimum. Conversely, the maximum calculation will assume a maximum contribution from the utility. Calculations shall take into consideration the parallel operation of synchronous generators with the electric utility, where applicable as well as any stand-by generator applications.

G. The Arc-Flash Hazard Analysis shall be performed utilizing mutually agreed upon facility operational conditions, and the final report shall describe, when applicable, how these conditions differ from worst-case bolted fault conditions.

H. The incident energy calculations must consider the accumulation of energy over time when performing arc flash calculations on buses with multiple sources. Iterative calculations must take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors should be decremented as follows:

   1. Fault contribution from induction motors should not be considered beyond 5 cycles.

I. For each piece of ANSI rated equipment with an enclosed main device, two calculations shall be made. A calculation shall be made for the main cubicle, sides, or rear; and shall be based on a device located upstream of the equipment to clear the arcing fault. A second calculation shall be made for the front cubicles and shall be based on the equipment's main device to clear the arcing fault. For all other non-ANSI rated equipment, only one calculation shall be required and it shall be based on a device located upstream of the equipment to clear the arcing fault.

J. When performing incident energy calculations on the line side of a main breaker (as required per above), the line side and load side contributions must be included in the fault calculation.

K. Mis-coordination should be checked amongst all devices within the branch containing the immediate protective device upstream of the calculation location and the calculation should utilize the fastest device to compute the incident energy for the corresponding location.
L. Arc Flash calculations shall be based on actual overcurrent protective device clearing time. A maximum clearing time of 2 seconds will be used based on IEEE 1584-2002 section B.1.2. Where it is not physically possible to move outside of the flash protection boundary in less than 2 seconds during an arc flash event, a maximum clearing time based on the specific location shall be utilized.
M. Provide the following:
   1. Results of the Arc-Flash Hazard Analysis shall be submitted in tabular form, and shall include device or bus name, bolted fault and arcing fault current levels, flash protection boundary distances, working distances, personal-protective equipment classes and AFIE (Arc Flash Incident Energy) levels.
   2. The Arc-Flash Hazard Analysis shall report incident energy values based on recommended device settings for equipment within the scope of the study.
   3. The Arc-Flash Hazard Analysis may include recommendations to reduce AFIE levels and enhance worker safety.

3.02. ARC FLASH LABELS

A. Engineering Services shall provide a 4.0 in. x 4.0 in. Brady thermal transfer type label of high adhesion polyester for each work location analyzed.
B. The labels shall be designed according to the following standards:
   1. UL969 – Standard for Marking and Labeling Systems
   2. ANSI Z535.4 – Product Safety Signs and Labels
   3. NFPA 70 (National Electric Code) – Article 110.16
C. The label shall include the following information:
   1. System Voltage
   2. Flash protection boundary
   3. Personal Protective Equipment category
   4. Arc Flash Incident energy value (cal/cm²)
   5. Limited, restricted, and prohibited Approach Boundaries
   6. Study report number and issue date
D. Labels shall be printed by a thermal transfer type printer, with no field markings.
E. Arc flash labels shall be provided for equipment as identified in the study and the respective equipment access areas per the following:
   1. Floor Standing Equipment - Labels shall be provided on the front of each individual section. Equipment requiring rear and/or side access shall have labels provided on each individual section access area. Equipment line-ups containing sections with multiple incident energy and flash protection boundaries shall be labeled as identified in the Arc Flash Analysis table.
   2. Wall Mounted Equipment – Labels shall be provided on the front cover or a nearby adjacent surface, depending upon equipment configuration.
   3. General Use Safety labels shall be installed on equipment in coordination with the Arc Flash labels. The General Use Safety labels shall warn of general electrical hazards associated with shock, arc flash, and explosions, and instruct workers to turn off power prior to work.

F. Labels shall be field installed by the Contractor. The technician providing the installation shall have completed an 8-Hour instructor led Electrical Safety Training Course which includes NFPA 70E material including the selection of personal protective equipment.

END OF SECTION

SECTION 26 09 23
LIGHTING CONTROLS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This section specifies the furnishing, installation and connection of the lighting controls.
B. Wireless lighting control system is based upon Lutron VIVE. All associated components shall be compatible for complete installation.

1.02 SECTION INCLUDES

A. Standalone Wired Occupancy Sensors
B. Wireless lighting control systems and associated components:
   1. Wireless occupancy/vacancy sensors.
   2. Wireless daylight sensors.
   3. Wired load control modules with wireless communication inputs.
   4. Wired wall dimmers and switches with wireless communication inputs.
   5. Wireless control stations.
   6. Power interfaces.
C. Wireless hub(s) for centralized control, monitoring, and system integration.
D. Emergency Shunt Relay

1.03 RELATED WORK

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.
B. Section 26 05 00 – Common Work Results for Electrical
C. Section 26 05 19 – Low Voltage Electrical Power Conductors and Cables
D. Section 26 27 26 – Wiring Devices

1.04 SUBMITTALS

A. In accordance with Section 26 05 00, submit the following:
B. Product Data: For each type of lighting control, submit the following information.
   1. Manufacturer's catalog data.
   2. Wiring schematic and connection diagram.
   3. Installation details and one-line diagrams.

1.05 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

1.06 COORDINATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression system and partition assemblies.

1.07 WARRANTY

A. Manufacturer's Standard Warranty, Without Manufacturer Full-Scope Start-Up:
   1. Manufacturer Lighting Control System Components, Except Wireless Sensors, Ballasts/Drivers and Ballast Modules: One year 100 percent parts coverage, no manufacturer labor coverage.
   2. Wireless Sensors: Five years 100 percent parts coverage, no manufacturer labor coverage.
   3. Ballasts/Drivers and Ballast Modules: Three years 100 percent parts coverage, no manufacturer labor coverage.
B. Manufacturer's Standard Warranty, With Manufacturer Full-Scope Start-Up:
   1. Manufacturer Lighting Control System Components, Except Lighting Management System Computer, Ballasts/Drivers and Ballast Modules:

a. First Two Years:
   1) 100 percent replacement parts coverage, 100 percent manufacturer labor coverage to troubleshoot and diagnose a lighting issue.
   2) First-available on-site or remote response time.
   3) Remote diagnostics for applicable systems.
b. Telephone Technical Support: Available 24 hours per day, 7 days per week, excluding manufacturer holidays.

2. Lighting Management System Computer: One year 100 percent parts coverage, one year 100 percent manufacturer labor coverage.

1.08 ADMINISTRATIVE REQUIREMENTS

A. Sensor Layout and Tuning: Include as part of the base bid Lighting Control Manufacturer's Sensor Layout and Tuning service**.**
   1. Lighting Control Manufacturer to take full responsibility for wired or wireless occupancy/vacancy and daylight sensor layout and performance for sensors provided by Lighting Control Manufacturer.
   2. Lighting Control Manufacturer to analyze the reflected ceiling plans, via supplied electronic AutoCAD format, and design a detailed sensor layout that provides adequate occupancy sensor coverage and ensures occupancy and daylight sensor performance per agreed upon sequence of operations. Contractor to utilize the layouts for sensor placement.
   3. During startup, Lighting Control Manufacturer to direct Contractor regarding sensor relocation, as required, should conditions require a deviation from locations specified in the drawings.
   4. Lighting Control Manufacturer to provide up to two additional post-startup on-site service visits, within one calendar year from Date of Substantial Completion to fine-tune sensor calibration per the agreed upon sequence of operations.

B. Coordination:
   1. Coordinate the placement of sensors and wall controls with millwork, furniture, equipment, etc. installed under other sections or by others.
   2. Coordinate the placement of wall controls with actual installed door swings.
   3. Coordinate the placement of daylight sensors with windows, skylights, and luminaires to achieve optimum operation. Coordinate placement with ductwork, piping, equipment, or other potential obstructions to light level measurement installed under other sections or by others.
   4. Coordinate the work to provide luminaires and lamps compatible with the lighting controls to be installed.
   5. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

C. Pre-Wire Meeting***;*** Include as part of the base bid Lighting Control Manufacturer to conduct on-site meeting prior to commencing work. Manufacturer to review with installer:
   1. Low voltage wiring requirements.
   2. Separation of power and low voltage/data wiring.
   3. Wire labeling.
   4. Wireless hub locations and installation.
   5. sensor locations to be reviewed in accordance with layout provided by Lighting Control Manufacturer. Lighting Control Manufacturer may direct Contractor regarding sensor relocation should conditions require a deviation from locations indicated.
   6. Control locations.
   7. Computer jack locations.
   8. Load circuit wiring.
   9. Network wiring requirements.
   10. Connections to other equipment.
   11. Installer responsibilities.

D. Sequencing:
   1. Do not install sensors and wall controls until final surface finishes and painting are complete.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Provide wireless lighting control system components and products by one of the following:
   1. Lutron

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following for Emergency Shunt Relay Devices:
   1. Lutron
   2. Wattstopper
   3. Functional Devices Inc.
   4. LVS Controls
   5. Square D

2.02 OCCUPANCY SENSORS

A. Non-system type, standalone occupancy sensors shall be hardwired type.

B. Wall Mounted (Wall Switch Type)
   1. The unit shall fit in/on a standard single gang switch box.
   2. Sensitivity shall be user adjustable or self-adjusting type.
   3. The delay timer shall be adjusted within a range of 6 to 30 minutes by the contractor in the field. The sensor shall have a test mode for performance testing.
   4. The off switch shall have manual override for positive off and automatic on.
   5. The test LED shall indicate motion.
   6. The unit shall have a five year warranty.
   7. See drawings for actual type of sensor and specification basis of design.
   8. All occupancy sensor shall contain an integral isolated relay with NO and NC outputs rated for 1 amp @ 30VDC/VAC. Sensors which are not available with required isolated relays shall be furnished with auxiliary relay pack (in addition to required power packs) for integration with HVAC VAV controllers.

C. Ceiling Mounted
   1. The unit shall fit in/on a standard octagon box. All ceiling mounted sensors shall be installed to a box with ring and box support.
   2. Line voltage sensors are acceptable, especially in exposed ceiling areas where all wiring shall be installed in conduit, including low voltage cabling if power packs are used. Provide power pack as required for low voltage sensors.
   3. Sensitivity shall be user adjustable or self-adjusting type.
   4. The delay timer shall be adjusted within a range of 6 to 30 minutes by the contractor in the field. The sensor shall have a test mode for performance testing.
   5. Test LED to indicate motion.
   6. The unit shall have a five year warranty.
   7. All occupancy sensor shall contain an integral isolated relay with NO and NC outputs rated for 1 amp @ 30VDC/VAC. Sensors which are not available with required isolated relays shall be furnished with auxiliary relay pack (in addition to required power packs) for integration with HVAC VAV controllers.
   8. Sensor power packs shall be universal voltage with hold-on, hold-off inputs to integrate with auxiliary devices such as daylight sensors.
   9. See drawings for actual type of sensor and specification basis of design.

2.03 WIRELESS CONTROL STATIONS

A. Provide and program iPad to control lighting in Storytime room.

B. Product(s):
   1. Type 2B - 2-Button Control; Lutron Pico Wireless Control.
      a. Button Marking: To be determined on shop drawings – standard offering
   2. Type 3BRL - 3-Button with Raise/Lower Control; Lutron Pico Wireless Control.
      a. Button Marking: To be determined on shop drawings – standard offering
   3. Type 4B - 4-Button with 3 Scenes and Off; Lutron Pico Wireless Control.

a. Button Marking: To be determined on shop drawings – standard offering
4. Screw Mounting Kit.
5. Wallplate Adapter.

C. Communicates directly to compatible RF receiving devices through use of a radio frequency communications link.
D. Does not require external power packs, power or communication wiring.
E. Allows for easy reprogramming without replacing unit.
F. Includes LED to indicate button press or programming mode status.
G. Mounting:
1. Capable of being mounted with a table stand or directly to a wall under a faceplate.
2. Faceplates: Provide concealed mounting hardware.
H. Power: Battery-operated with minimum ten-year battery life (3-year battery life for night light models).
I. Finish: Light Almond.
J. Wall plates
1. Manufacturer: Same as manufacturer of devices, for aesthetically compatible installation.
2. Provide screwless wall plates with concealed mounting hardware and alignment adapter plate, suitable for the quantity and types of devices to be installed.
3. List as complying with UL 514C.

2.04 WIRED WALL DIMMERS AND SWITCHES WITH WIRELESS COMMUNICATION INPUTS

A. General Requirements:
1. Provide air gap service switch to disconnect power to load for safe lamp replacement, accessible without removing faceplate.
2. Operates at the rated capacity across the full ambient temperature range including modified capacities for ganged configurations which require removal of fins.
3. Provide radio frequency interference suppression.
4. Surge Tolerance: Designed and tested to withstand surges of 6,000 V, 200 amps according to IEEE C62.41.2 without impairment to performance.
5. Dimmers: Provide full range, continuously variable control of light intensity.
6. Dimmers for Electronic Low Voltage (ELV) Transformers:
a. Provide circuitry designed to control the input of electronic (solid-state) low voltage (ELV) transformers. Do not use dimmers that utilize standard phase control.
b. Provide resettable overload protection that provides automatic shut-off when dimmer capacity is exceeded. Do not use protection methods that are non-resettable or require device to be removed from outlet box.
c. Designed to withstand a short, per UL 1472, between load hot and either neutral or ground without damage to dimmer.
7. Dimmers for Magnetic Low Voltage (MLV) Transformers:
a. Provide circuitry designed to control and provide a symmetrical AC waveform to input of magnetic low voltage transformers per UL 1472.
b. Magnetic low voltage transformers to operate below rated current or temperature.
8. Electronic Switches:
a. Listed as complying with UL 20, UL 508, and UL 1472.
9. Wall plates
a. Manufacturer: Same as manufacturer of devices, for aesthetically compatible installation.
b. Provide screwless wall plates with concealed mounting hardware and alignment adapter plate, suitable for the quantity and types of devices to be installed.
c. List as complying with UL 514C.
10. Finish: Light Almond.

B. Preset Smart Wall Dimmers and Switches with Wireless Communication Inputs; Lutron Maestro Wireless Series:
1. Communicates via radio frequency with up to ten compatible occupancy/vacancy sensors, ten wireless control stations, and one daylight sensor.
2. Dimmer Control: Multi-function tap switch with small, raised rocker for dimmer adjustment.
a. Rocker raises/lowers light level, with new level becoming the current preset level.
b. Switch single tap raises lights to preset level or fades lights to off.

c. Switch double tap raises light to full on level.
d. Switch tap and hold slowly fades lights to off over period of 10 seconds.
e. LEDs adjacent to tap switch indicate light level when dimmer is on, and function as locator light when dimmer is off.

3. Switch Control: Switch single tap turns lights on/off.
4. Dimmer High End Trim:
   a. Incandescent Dimmers: Minimum of 92 percent of line voltage.
   b. Dimmers for Electronic Low Voltage (ELV) Transformers: Minimum of 95 percent of line voltage.
   c. Dimmers for Magnetic Low Voltage Transformers: Minimum of 92 percent of line voltage.
5. Product(s) - Preset Smart Dimmers with Wireless Communication Inputs:
   a. Type WD - Preset Smart Dimmer; Lutron Maestro Wireless Series: Incandescent/halogen (600 W, 120 V), magnetic low voltage (600 VA/450 W, 120 V), dimmable CFL/LED (150 W, 120 V); multi-location capability using companion dimmers (up to nine companion dimmers may be connected); minimum load requirement.
   b. Type WD Preset Smart Dimmer; Lutron Maestro Wireless Series: Electronic low voltage (600 W, 120 V); neutral required; multi-location capability using companion dimmers (up to nine companion dimmers may be connected); minimum load requirement.

2.05 LOAD CONTROL MODULES FOR WIRELESS SENSORS

A. Provide wireless load control modules as indicated or as required to control the loads as indicated.
B. Junction Box-Mounted Modules:
   1. Communicates via radio frequency with up to nine compatible wireless control stations, up to six occupancy/vacancy sensors, and one daylight sensor.
   2. Plenum rated.
   3. Dimming Modules:
      a. Product(s):
         1) 8 A dimming module with 0-10V control; Lutron PowPak Dimming Module Model RMJS-8T-DV-B;
      b. Single low voltage dimming module with Class 1 or Class 2 isolated 0-10V output signal conforming to IEC 60929 Annex E.2; source or sink automatically configures.
      c. Configurable high- and low-end trim.
      d. Relay: Rated for 0-10 V ballasts, LED drivers, or fixtures that conform with NEMA 410.
      e. Selectable minimum light level.
      f. Configurable high- and low-end trim.
   4. Relay Modules:
      a. Product(s):
         1) 16 A relay module, without contact closure output; Lutron PowPak Relay Module Model RMJS-16R-DV-B.
         2) 16 A relay module, with contact closure output; Lutron PowPak Relay Module Model RMJS-16RCCO1-DV-B.
      b. Relay:
         1) Rated Life of Relay: Typical of 1,000,000 cycles at fully rated 16 A for all lighting loads.
         2) Load switched in manner that prevents arcing at mechanical contacts when power is applied to and removed from load circuits.
         3) Fully rated output continuous duty for inductive, capacitive, and resistive loads.
      c. Contact Closure Output:
         1) Single contact closure output with normally open and normally closed dry maintained contacts suitable for connection to third party equipment (e.g. building management system, HVAC system, etc.).
         2) Contact Ratings: Resistive load; 1 A at 0-24 VDC, 0.5 A at 0-24 VAC.
         3) Contact closure modules shall be provided by the electrical contractor and turned over to HVAC contractor for installation on VAV. CCO device 24V power provided from building automation system.
   5. Contact Closure Output Modules:
      a. Product: Lutron PowPak CCO Module Model RMJS-CCO1-24-B.

b. Contact Closure Output:
   1) Single contact closure output with normally open and normally closed dry maintained contacts suitable for connection to third party equipment (e.g. building management system, HVAC system, etc.).
   2) Contact Ratings: Resistive load; 1 A at 0-24 VDC, 0.5 A at 0-24 VAC.
   3) Controlled by associated occupancy/vacancy sensors and wall controls.

2.06 WIRELESS SENSORS

A. General Requirements:
   1. Operational life of 10 years without the need to replace batteries when installed per manufacturer's instructions.
   2. Communicates directly to compatible RF receiving devices through use of a radio frequency communications link.
   3. Does not require external power packs, power wiring, or communication wiring.
   4. Capable of being placed in test mode to verify correct operation from the face of the unit.

B. Wireless Occupancy/Vacancy Sensors:
   1. General Requirements:
      a. Provides a clearly visible method of indication to verify that motion is being detected during testing and that the unit is communicating to compatible RF receiving devices.
      b. Utilize multiple segmented lens, with internal grooves to eliminate dust and residue build-up.
      c. Sensing Mechanism: Passive infrared coupled with technology for sensing fine motions; Lutron XCT Technology. Signal processing technology detects fine-motion passive infrared (PIR) signals without the need to change the sensor's sensitivity threshold.
      d. Provide optional, readily accessible, user-adjustable controls for timeout, automatic/manual-on, and sensitivity.
      e. Turns off lighting after reasonable and adjustable time delay once the last person to occupy the space vacates a room or area. Provide adjustable timeout settings of 1, 5, 15, and 30 minutes.
      f. Capable of turning dimmer's lighting load on to an optional locked preset level selectable by the user. Locked preset range to be selectable on the dimmer from 1 percent to 100 percent.
      g. Provide necessary mounting hardware and instructions for both temporary and permanent mounting.
      h. Provide temporary mounting means for drop ceilings to allow user to check proper performance and relocate as needed before permanently mounting sensor. Temporary mounting method to be designed for easy, damage-free removal.
      i. Sensor lens to illuminate during test mode when motion is detected to allow installer to place sensor in ideal location and to verify coverage prior to permanent mounting.
      j. Ceiling-Mounted Sensors:
         1) Provide surface mounting bracket compatible with drywall, plaster, wood, concrete, and compressed fiber ceilings.
         2) Provide recessed mounting bracket compatible with drywall and compressed fiber ceilings.
         3) Color: White.
      k. Wall-Mounted Sensors:
         1) Provide wall or corner mounting brackets compatible with drywall and plaster walls.
         2) Color: To be determined on shop drawings – standard offering
   2. Wireless Combination Occupancy/Vacancy Sensors:
      a. Ceiling-Mounted Sensors: Programmable to operate as an occupancy sensor (automatic-on and automatic-off), an occupancy sensor with low light feature (automatic-on when less than one footcandle of ambient light available and automatic-off), or a vacancy sensor (manual-on and automatic-off).
      b. Wall-Mounted Sensors: Programmable to operate as an occupancy sensor (automatic-on and automatic-off), or a vacancy sensor (manual-on and automatic-off).
      c. Product(s):
         1) Ceiling-Mounted Occupancy/Vacancy Sensor; Lutron Radio Powr Savr Series, Model LFR2-OCR2B-P-WH: Coverage from 324 square feet (30.2 sq m) to 676 square feet

(62.4 sq m) depending on ceiling height from 8 to 12 feet (2.4 to 3.7 m); 360 degree field of view.

2) Wall-Mounted Occupancy/Vacancy Sensor; Lutron Radio Powr Savr Series, Model LFR2-OWLB-P-WH: Minor motion coverage of 1500 square feet (139.4 sq m) and major motion coverage of 3000 square feet (278.7 sq m) with mounting height of 6 to 8 feet (1.6 to 2.4 m); 180 degree field of view.
3) Corner-Mounted Occupancy/Vacancy Sensor; Lutron Radio Powr Savr Series, Model LFR2-OKLB-P-WH: Minor motion coverage of 1225 square feet (113.8 sq m) and major motion coverage of 2500 square feet (232.3 sq m) with mounting height of 6 to 8 feet (1.6 to 2.4 m); 90 degree field of view.
4) Hallway Occupancy/Vacancy Sensor Lutron Radio Powr Savr Series, Model LFR2-OHLB-P-WH: Major motion coverage of up to 150 feet (45.7 m) with mounting height of 6 to 8 feet (1.6 to 2.4 m); narrow field of view.

3. Wireless Vacancy-Only Sensors:
   a. Product(s):
      1) Ceiling-Mounted Vacancy-Only Sensor; Lutron Radio Powr Savr Series, Model LFR2-VCR2B-P-WH: Coverage from 324 square feet (30.2 sq m) to 676 square feet (62.4 sq m) depending on ceiling height from 8 to 12 feet (2.4 to 3.7 m); 360 degree field of view.
      2) Wall-Mounted Vacancy-Only Sensor; Lutron Radio Powr Savr Series, Model LFR2-VWLB-P-WH. Minor motion coverage of 1500 square feet (139.4 sq m) and major motion coverage of 3000 square feet (278.7 sq m) with mounting height of 6 to 8 feet (1.6 to 2.4 m); 180 degree field of view.
      3) Corner-Mounted Vacancy-Only Sensor; Lutron Radio Powr Savr Series, Model LFR2-VKLB-P-WH: Minor motion coverage of 1225 square feet (113.8 sq m) and major motion coverage of 2500 square feet (232.3 sq m) with mounting height of 6 to 8 feet (1.6 to 2.4 m); 90 degree field of view.
      4) Hallway Vacancy-Only Sensor; Lutron Radio Powr Savr Series, Model LFR2-VHLB-P-WH: Major motion coverage of up to 150 feet (45.7 m) with mounting height of 6 to 8 feet (1.6 to 2.4 m); narrow field of view.

2.07 WIRELESS HUBS

A. Product(s):
   1. Wireless hub; Lutron Vive Hub.
      a. Flush-mount wireless hub; Model HJS-1-FM.
B. Integrated multicolor LED provides feedback on what mode the hub is in for simple identification and diagnosis.
C. Integrated processor and web server allows hub to set up and operate the system without any external connections to outside processors, servers, or the internet.
D. Utilizes Ethernet connection for:
   1. Networking up to 64 hubs together to create a larger system.
   2. Remote connectivity capabilities, including maintaining system date/time and receiving periodic firmware updates (requires internet connection).
E. A single hub or network of hubs can operate on either a dedicated lighting control only network or can be integrated with an existing building network as a VLAN.
F. Communicates directly to compatible Lutron Vive RF devices through use Lutron Clear Connect radio frequency communications link; does not require communication wiring; RF range of 71 feet (23 m) through walls to cover an area of 15836 square feet (1471 sq m) (device and hub must be on the same floor).
G. Communicates directly to mobile device (smartphone or tablet) or computer using built-in Wi-Fi, 2.4 GHz 802.11b/g; wireless range of 71 feet (23 m) through walls (device and hub must be on the same floor).
   1. Does not require external Wi-Fi router for connecting to the hub.
H. Allows for system setup, control, and monitoring from mobile device or computer using Vive web-based software:
   1. Supports up to 700 total paired devices including compatible wireless sensors, wireless control stations, and wireless load devices.

2. Allows for timeclock scheduling of events, both time of day and astronomic (sunrise and sunset).
    a. Timeclock is integrated into the unit and does not require a constant internet connection.
    b. Retains time and programming information after a power loss.
    c. Utilizes weekly calendar view for monitoring and adjustment of scheduled events.
    d. Time clock events can be scheduled to:
        1) Send lights to a desired level.
        2) Adjust level lights go to when occupied.
        3) Adjust level lights go to when unoccupied.
        4) Enable/disable occupancy.
        5) Adjust timeout of sensors.
3. Daylighting:
    a. Daylighting can be enabled/disabled. Can be used to override the control currently taking place in the space.
    b. Daylight set point can be adjusted with the software to increase or decrease the electric light level in the room based on the same amount of natural light.
4. Uses RF signal strength detection to find nearby devices for quick association and programming without having to climb ladders.
    a. Association and setup does not require a factory technician to perform.
5. System using Lutron Vive wireless hub(s) can operate with or without connection to the internet.
6. Supports energy reporting.
    a. Reports measured energy data for PowPak fixture control modules at accuracy of plus/minus 2 percent or 0.5 W (whichever is higher).
    b. Reports calculated energy data for PowPak junction box mounted modules at accuracy of 10 percent.
7. Supports automatic demand response for load shedding via:
    a. Local contact closure without need for separate interface.
    b. BACnet (Lutron Vive Premium wireless hub with BACnet only).
8. Wireless hub can be firmware upgraded to provide new software features and system updates.
    a. Firmware update can be done either locally using a wired Ethernet connection or Wi-Fi connection, or remotely if the wireless hub is connected to the internet.

I. Lutron Vive Web-Based Application:
1. Accessibility and Platform Support:
    a. Web-based; runs on most HTML5 compatible browsers (including Safari and Chrome).
    b. Supports multiple platforms and devices; runs from a tablet, desktop, laptop, or smartphone.
    c. User interface supports multi-touch gestures such as pinch to zoom, drag to pan, etc.
    d. Utilizes HTTPS (industry-standard certificate-based encryption and authentication for security).
    e. Multi-level Password Protected Access: Individual password protection on both the integrated Wi-Fi network and web-based software.
    f. WPA2 security for Wi-Fi communication with wireless hub.
2. System Navigation and Status Reporting:
    a. Area Tree View: Easy navigation by area name to view status and make programing adjustments through the software.
    b. Area and device names can be changed in real time.
3. Setup app available for iOS and Android that allows for:
    a. Job registration to extend product warranty.
    b. Management of setup for multiple projects in different locations.
    c. Creation of handoff documents that are sent directly to a facility manager via email once setup is complete.
    d. Access to native help and instructions to assist user with Vive system setup.

J. Contact Closure Interface: Provide two contact closure inputs; accepts both momentary and maintained contact closures that can be used for automatic demand response.

K. Rated for use in air-handling spaces as defined in UL 2043.

2.08 EMERGENCY SHUNT RELAY

A. Description: The emergency lighting control unit shall allow control of emergency lighting fixtures in tandem with normal lighting in an area while ensuring that emergency lighting will turn on immediately to full brightness upon loss of normal power supplying the control device. Emergency lighting operation shall be independent for each controlled area and shall not require a generalized power failure for proper operation.
B. The device shall have normally closed dry contacts capable of switching 20 amp emergency ballast loads @ 120-277 VAC, 60 Hz, or 10 amp tungsten loads @ 120 VAC, 60 Hz.
C. The device shall have universal rated voltage inputs provided for normal power sense and normal switched power at 120-277 VAC, 60 Hz.
D. Where noted on the drawings, device shall be capable of shunting 0-10VDC dimming signal to force luminaire to full output upon loss of normal power.
E. UL924 listed

2.09 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. AWG/Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

PART 3 EXECUTION

3.01 INSTALLATION

A. Installation shall be in accordance with the NEC, manufacturer's instructions and as shown on the drawings or specified.
B. Install load control modules near point of use. Mark location on record drawings.
C. Set occupancy and vacancy sensors and control devices as noted on the drawings.
D. Set wireless scene recall devices as noted on drawings or directed by owner.
E. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.
F. Contact closure modules (CCI) shall be provided and installed by the electrical contractor. Mount device on or near associated VAV. CCI device 24V power provided from building automation system VAV control power. Wiring between VAV controller and CCI device by HVAC Contractor.

3.02 ACCEPTANCE CHECKS AND TESTS

A. Perform in accordance with the manufacturer's recommendations.
B. Upon completion of installation, conduct an operating test to show that equipment operates in accordance with requirements of this section.
C. Test for full range of dimming ballast and dimming controls capability. Observe for visually detectable flicker over full dimming range.
D. Test occupancy sensors for proper operation. Observe for light control over entire area being covered.
E. Upon completion of the installation, the system shall be commissioned by the manufacturer's factory-authorized technician who will verify all adjustments and sensor placements.

3.03 FOLLOW-UP VERIFICATION

A. Upon completion of acceptance checks and tests, the Contractor shall show by demonstration in service that the lighting control devices are in good operating condition and properly performing the intended function.

3.04 FIELD QUALITY CONTROL

A. Manufacturer's Full-Scope Start-Up Service: Provide On-Site Full-Scope
   1. On-Site Full-Scope Start-Up Service*;* Manufacturer's authorized Service Representative to conduct site visit upon completion of lighting control system installation to perform system startup and verify proper operation:
      a. authorized Service Representative to verify sensor locations, in accordance with layout provided by Lighting Control Manufacturer; Lighting Control Manufacturer may direct Contractor regarding sensor relocation should conditions require a deviation from locations indicated.
      b. Verify connection of power wiring and load circuits.
      c. Verify connection and location of controls.
      d. Energize wireless hubs.
      e. Associate occupancy/vacancy sensors, daylight sensors, wireless remotes, and wall stations to load control devices.
      f. Provide initial rough calibration of sensors; fine-tuning of sensors is responsibility of Contractor unless provided by Lighting Control Manufacturer as part of Sensor Layout and Tuning service.
      g. Program timeclock schedules per approved sequence of operations.
      h. Configure load shed parameters per approved sequence of operations.
      i. Verify system operation control by control.
      j. Obtain sign-off on system functions.
      k. Train Owner's representative on system capabilities, operation, and maintenance.
B. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.

3.05 ADJUSTING

A. On-Site Scene and Level Tuning: Include as part of the base bid Lighting Control Manufacturer to visit site to conduct meeting with Engineer; Owner's representative; Lighting Designer; to make required lighting adjustments to the system for conformance with original design intent.

3.06 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

A. Demonstration:
   1. Demonstrate proper operation of lighting control devices to Owner and correct deficiencies or make adjustments as directed.
B. Training:
   1. Include services of manufacturer's certified service representative to perform on-site training of Owner's personnel on operation, adjustment, and maintenance of lighting control system as part of on-site system start-up services.

3.08 SEQUENCE OF OPERATION SUMMARY

A. Tutor, Makerspace, Offices, Staff, Delivery, Training Room, Community Room and Similar enclosed spaces.
   1. Lighting shall operate through the use of 0-10VDC dimming room control modules and wireless control stations containing ON, 1 preset, raise/lower and OFF buttons.
   2. Wall control station ON button shall be set to achieve 35 FC on the workplane. The preset button shall reduce the ON preset lighting output by 50%.
   3. Occupancy sensor Auto ON feature shall be enabled. Timeout shall be 15 minutes with a 15 second grace period. Motion sensing within the grace period shall automatically turn the lights back on to their previous state. Sensors shall be wireless.
   4. Contact closure device with NO/NC dry contacts shall communicate room occupancy status to BMS system for VAV occupied/unoccupied setpoints. The contract closure shall operate independently of the room lighting state.

B. Open Stack Area Library
   1. Lighting shall operate through the use of 0-10VDC dimming room control modules and wireless control stations containing 3 ON preset and OFF buttons.
   2. The space will have up to 3 presets recorded at levels which will be determined by A/E at systems start up.
   3. Time of day control shall be provided by way of Vive system time clock.
   4. On Monday - Friday: Lighting shall automatically turn ON at 8AM to preset A and relinquish control to local devices. At 10:00PM the lighting shall be dimmed to 50%. At 11:00PM all non-emergency lighting shall be turned OFF. Remaining emergency lighting shall be dimmed to 20% until next ON command.
   5. On Saturday: Lighting shall automatically turn ON at 8AM to preset A and relinquish control to local devices. At 7:00PM the lighting shall be dimmed to 50%. At 9:00PM all non-emergency lighting shall be turned OFF. Remaining emergency lighting shall be dimmed to 20% until next ON command.
   6. Lighting shall remain in afterhours state on Sunday and Holidays.
   7. A blink warning shall be initiated 2 minutes before each change in lighting state. Local occupancy sensors shall have the ability to override timed events. If room is occupied, the timeclock shall not change the lighting state. The timed event shall occur 5 minutes after no occupancy is detected.
   8. Four button control stations with OFF and raise/lower buttons to temporarily adjust the active zone at room entries. Stations shall wired or wireless.
   9. Daylight sensors shall continuously monitor the interior light level and automatically vary the output of the assigned lighting zones. OFF setpoint is 30FC and higher measured at the floor. Sensors shall be wired or wireless
   10. Contact closure device with NO/NC dry contacts shall communicate room occupancy status to BMS system for VAV occupied/unoccupied setpoints. The contract closure shall operate independently of the room lighting state.

END OF SECTION

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SECTION 26 24 16
PANELBOARDS

PART 1 – GENERAL

1.01 SCOPE OF WORK
A. The work under this section includes main, distribution and branch circuit panelboards.

1.02 SECTION INCLUDES
A. Main and Distribution Panelboards
B. Branch Circuit Panelboards

1.03 RELATED WORK
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this section.
B. Section 26 05 73 – Short Circuit/Coordination Study and Arc Flash Hazard Study
C. Section 26 27 30 – Contactors
D. Section 26 43 13 – Surge Protective Devices for Low Voltage Electrical Power

1.04 SUBMITTALS
A. Include outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, and circuit breaker arrangement and sizes.

1.05 OPERATION AND MAINTENANCE DATA
A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

1.06 COORDINATION
A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
B. Coordinate sizes and location of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
C. Distribution panels and branch circuit panelboards manufacturer shall be the same manufacturer as switchboards, motor starters and disconnect switches.

1.07 SPARE PARTS
A. Keys: Furnish 2 keys for each panelboard to Owner.

PART 2 – PRODUCTS

2.01 MAIN AND DISTRIBUTION PANELBOARDS
A. Panelboards: Circuit breaker type. Service Entrance Rated
B. Enclosure: NEMA 250 Type 1. Minimum cabinet size: 5-3/4 inches (144 mm) deep; 20 inches (508 mm) wide, with 5" minimum gutter space top and bottom. Constructed of galvanized code gauge steel.
C. Provide cabinet front with hinged door with flush lock. Front cover shall be hinged to allow access to wiring gutters without removal of panel trim and standard door within hinged trim cover. Hinged trim shall be held in place with concealed trim clamps. Finish in manufacturer's standard gray enamel.
D. Skirt for Surface-Mounted Panelboards shall be the same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
E. Gutter Extension and Barrier shall be the same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
F. Provide metal directory holders with clear plastic covers.

G. Provide panelboards with copper or aluminum bus, ratings as scheduled on Drawings. Provide ground bars in all panelboards. All spaces shall have bus fully extended and drilled for the future installation of breakers.
H. Provide extra capacity neutral bus when scheduled rated 200 percent of phase and UL Listed as suitable for non-linear loads.
I. Feed-Through Lugs when scheduled shall be suitable for use with conductor material and located at opposite end of bus from incoming lugs or main device.
J. Subfeed (Double) Lugs when scheduled shall be suitable for use with conductor material and located at same end of bus as incoming lugs or main device.
K. Extra-Capacity Neutral Lugs when scheduled shall be rated 200 percent of phase lugs mounted on extra-capacity neutral bus.
L. Provide UL Listed service equipment label for use as service equipment for panelboards where required with one or more main service disconnecting and overcurrent protective devices.
M. Minimum System (i.e. individual component) Short Circuit Rating: As shown on the Drawings.
N. Molded Case Circuit Breakers:
   1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250A and larger.
   2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
   3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
      a. Instantaneous trip.
      b. Long- and short-time pickup levels.
      c. Long- and short-time time adjustments.
      d. Ground-fault pickup level, time delay, and I^2t response.
   4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.

2.02 BRANCH CIRCUIT PANELBOARDS

A. Lighting and Appliance Branch Circuit Panelboards: Circuit breaker type.
B. Enclosure: Type 1. Minimum cabinet size: 5-3/4 inches (144 mm) deep; 20 inches (508 mm) wide with 5" minimum gutter space top and bottom. Constructed of galvanized code gauge steel. Panel enclosure (back box) shall be of non-stamped type (without KO's) to avoid concentric break out problem.
C. Provide surface cabinet front with concealed trim clamps, concealed hinge and flush cylinder lock all keyed alike. Front cover shall be hinged to allow access to wiring gutters without removal of panel trim. Hinged trim shall be held in place with screw fasteners. Finish in manufacturer's standard gray enamel.
D. Provide metal directory holders with clear plastic covers.
E. Provide panelboards with copper or aluminum bus, ratings as scheduled on Drawings. Provide ground bars in all panelboards. All spaces shall have bus fully extended and drilled for the future installation of breakers.
F. Minimum System (i.e. individual component) Short Circuit Rating: As shown on the Drawings.
G. Molded Case Circuit Breakers:
   1. Bolt-on type thermal magnetic trip circuit breakers.
   2. Provide UL Class A ground fault interrupter circuit breakers where shown on Drawings.
   3. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.
   4. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250A and larger.
   5. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
H. Do not use tandem circuit breakers.
I. Circuit breakers shall be bolt-on type with common trip handle for all poles. No handle ties of any sort will be permitted.
J. All of the panelboards provided under this section shall be by the same manufacturer.

PART 3 – EXECUTION

3.01 INSTALLATION

A. See section 26 05 29 for support requirements.
B. Install panelboards plumb with wall finishes.
C. Height: 6 ft. (2 m) to top or 6 ft. to center of breaker handle.
D. Install a crimp type stud termination to stranded conductor when terminating on circuit breakers without a captive assembly rated for terminating stranded conductors.
E. Provide filler plates for unused spaces in panelboards.
F. See section 26 05 53 for identification requirements. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.
G. Stub three (3) empty ¾" conduits to accessible location above ceiling or below floor out of each recessed panelboard. Cap these conduits to prevent material from entering them.

3.02 FIELD QUALITY CONTROL

A. If aluminum conductors size #1/0 and larger (per Section 26 05 19) are to be used as panelboard feeders, it is the responsibility of the contractor to provide panelboards with adequate wire bending space to accommodate the aluminum conductors and terminators to meet allowable code requirements. The Contractor shall circuit the panelboards as shown on the drawings. Measure steady state load currents at each panelboard feeder. Should the difference at any panelboard between phases exceed 10 percent, rearrange circuits in the panelboard to balance the phase loads within 10 percent.
B. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections.

3.03 ADJUSTING

A. Adjust al operating mechanisms for free mechanical movement.
B. Adjust trip and time delay settings to values as recommended in coordination study provided by manufacturer or as instructed by the A/E. Include a copy of the coordination study and recommended circuit breaker set points in the O & M Manual.

3.04 TRAINING

A. See Section 26 05 00 for general training requirements.
B. In addition to the training provided in Section 26 05 00, provide an additional 1 hour of training for each type of panelboard provided on the project.

END OF SECTION

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SECTION 26 26 53
ELECTRIC VEHICLE CHARGING EQUIPMENT - LEVEL 2

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY
A. Section includes EV charging equipment that provides Level 2 EV charging.

1.03 DEFINITIONS
A. EV: Electric vehicle.
B. EV Cable: The off-board cable containing the conductor(s) to connect the EV power controller to the EV that provides both power and communications during energy transfer.
C. EV Capable: Parking spaces that include nearby termination of raceway (conduit) to a power source with sufficient electrical panel capacity designed for simultaneous charging of electric vehicles in all planned EV parking spaces. Electrical wiring need not be pulled through raceway (conduit) until charging station is installed.
D. EV Charger or EV Charging Equipment: See "EVSE".
E. EV Connector: A conductive device that, when electrically coupled to an EV inlet, establishes an electrical connection to the EV for the purpose of power transfer and information exchange. This device is part of the EV coupler.
F. EV Coupler: A mating EV inlet and connector set.
G. EV Inlet: The device in the vehicle into which the EV connector is inserted, and a conductive connection is made for the transfer of power and communication. This device is part of the EV coupler.
H. EV Make Ready: Parking spaces that include nearby termination of raceway (conduit) <u>and electrical wiring pulled</u> to a power source with sufficient electrical panel capacity for simultaneous charging of electric vehicles in all EV parking spaces.
I. EVSE: Electric Vehicle Supply Equipment. It includes the EV charging equipment and conductors, including the ungrounded, grounded, and equipment grounding conductors and EV cables, attachment plugs, and all other fittings, devices, power outlets, or apparatus installed specifically for transferring energy between the premise wiring and the EV.

1.04 PREINSTALLATION MEETINGS
A. Preinstallation Conference: Conduct conference at Project site.

1.05 ACTION SUBMITTALS
A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for EV charging equipment.
   2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
B. Shop Drawings: For EV charging equipment.
   1. Include plans, elevations, sections, and mounting details.
   2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Detail fabrication and assembly of mounting assemblies for EV charging equipment.
   4. Include diagrams for power, signal, and control wiring.
   5. Include verification of wireless communications service at each location of EV charging equipment.

1.06 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Area plans and details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
   1. Structural members to which equipment will be attached.
   2. Electrical service.
   3. Communications service including wireless communications equipment.

1.07 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For EV charging equipment to include in operation and maintenance manuals.
B. Software and Firmware Operational Documentation:
   1. Online training and help documentation.
   2. Station activation sticker.

1.08 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
C. Comply with UL 2231-1. UL 2231-2, UL 2594, and NEC Article 625.
D. Comply with SAE J1772.
E. Comply with FCC Part 15 Class A.

1.09 FIELD CONDITIONS

A. Wireless Survey: Complete wireless survey to determine if wireless provider signals meet or exceed manufacturer's recommended minimum values.
B. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
   1. Ambient Temperature: Not exceeding minus 22 to plus 122 deg F (minus 30 to plus 50 deg C).
   2. Altitude: Not exceeding 6600 feet (2000 m).
C. Rate Equipment for non-operation under the following conditions:
   1. Ambient Temperature: Not exceeding minus 40 to plus 140 deg F (minus 40 to plus 60 deg C).
   2. Altitude: Not exceeding 6600 feet (2000 m).

1.10 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components of EV charging units that fail(s) in materials or workmanship within specified warranty period.
   1. Standard Warranty Period: One year from date of Substantial Completion.
   2. Extended Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design Product: Provide ChargePoint CT4000 family of electric vehicle charging stations for commercial applications.
B. Source Limitations: Obtain EV charging equipment from single manufacturer.

2.02 EV CHARGING EQUIPMENT DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. Comply with NFPA 70.
C. ADA compliant.
D. Metering: +/- 2 percent from 2 percent to full scale of output (30 A).
E. EV Charging Equipment Mounting: Bollard mount.
F. Enclosures:
    1. Rated for environmental conditions at installed location.
        a. Outdoor Locations: NEMA 250, Type 3R.
        b. Aluminum and UV-resistant plastic.
        c. Paint and Anodized.
        d. Charging components protected by security screws.
        e. Charging connectors in locking holsters.
        f. Meter, modem, and CPU, tamper resistant.
G. EV Cable and Connectors:
    1. SAE J1772 connector.
    2. Two connectors with locking holster.
    3. 18-foot (5.5 m) cable with cable management system.
H. Status Indicators:
    1. LEDs to indicate power, vehicle charging, charging complete, system status, faults, and service, as well as authorization.
I. Display Screen:
    1. VGA-resolution, daylight-viewable LCD screen with UV protection. Daylight readable and fingerprint resistant.
    2. Displays power, charging, charging complete, remote control, system status, faults, payment and pricing details, and service.
J. Networking:
    1. WAN Communications: Cellular GSM/GPRS and CDMA.
    2. LAN Communications: 2.4 GHz Wi-Fi 802.11b/g/n.
    3. Capable of remote configuration, diagnostics and reporting.
    4. Capable of remote software updates (future proof).
K. Payment System:
    1. RFID (ISO 15693, ISO 14443), NFC, Contactless credit card reader.
    2. PCI (Payment Card Industry) compliant.
    3. Capable of remote control and authorization including mobile phone application or toll free phone number.
L. Charging Network: Compatible with the ChargePoint EV charging network.
    1. Multiple units shall independently connect to charging network.
    2. Individual units shall be capable of indicating station status and availability providing or connecting user to customer support and remote control.

2.03 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
B. Surge Withstand: 6 kV at 3000 A.
C. Integral GFCI.
D. Auto-GFCI fault retry.
E. Input Power:
    1. Two 40 A, 208/240-V ac, 60 Hz, single phase per charger.
    2. Dual circuits do not need to be interlocked.
F. EV Charging Levels:
    1. Dual vehicles, AC Level 2 at up to 7.2 kW (CT4000) per vehicle.

2.04 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
B. Examine roughing-in for EV charging equipment electrical conduit to verify actual locations of conduit connections before equipment installation.
C. Examine walls, floors, and pavement for suitable conditions where EV charging equipment will be installed.
D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with NECA 1 and NECA 413.
B. Concrete Base Mounting:
   1. Install EV charging equipment on 6-inch (150-mm) nominal-thickness concrete base. Base should be 24-inch (600 mm) diameter or square (minimum 12-inch (300 mm) from the center located conduit stub-up). Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete".
      a. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
      b. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
      c. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
      d. Install anchor bolts to elevations required for proper attachment to supported equipment.
      e. Secure EV charging equipment to concrete base according to manufacturer's written instructions.
C. Bollard Mounting:
   1. Allow a minimum of 24 inches (600 mm) of clearance around EV charging equipment.
   2. EV charging equipment receptacles or holders shall be not less than 24 inches (600 mm) and not more than 4 feet (1.2 m) above finished grade.
   3. Mount EV charging equipment plumb and rigid without distortion of enclosure.
   4. Secure EV charging equipment according to manufacturer's written instructions.
D. Wiring Method: Install cables in raceways and cable trays. Conceal raceway and cables except in unfinished spaces.
   1. Comply with requirements for raceways and boxes specified in Section 26 05 33 "Raceways and Boxes for Electrical Systems."
E. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
F. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
G. Secure covers to enclosure.

3.03 CONNECTIONS

A. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

B. Comply with grounding requirements in Section 26 05 26 "Grounding and Bonding for Electrical Systems."
C. Comply with requirements for installation of conduit in Section 26 05 33 "Raceways and Boxes for Electrical Systems." Drawings indicate general arrangement of conduit, fittings, and specialties.
D. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

3.04 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.05 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
B. Tests and Inspections:
   1. For each unit of EV charging equipment, perform the following tests and inspections:
      a. Unit self-test.
      b. Operation test with EV.
      c. Network communications test.
C. EV charging equipment will be considered defective if it does not pass tests and inspections.
D. Prepare test and inspection reports.

3.06 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.
   1. Complete installation and startup checks according to manufacturer's written instructions.

3.07 ONGOING MANAGEMENT SERVICES

A. Engage a station manufacturer that offers a service to manage the administration and policies of the electric vehicle charging stations on an ongoing basis.

3.08 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for the duration of an active ChargePoint Network Service Plan.
B. Upgrade Service: At Substantial Completion, remotely update software to latest version. Install and program software upgrades that become available while an active ChargePoint Network Service Plan is maintained. Upgrading software shall include operating system and new or revised licenses for using software.

3.09 DEMONSTRATION

A. Utilize ChargePoint Station Management Services and ChargePoint Assure Services, or Train Owner's maintenance personnel to adjust, operate, and maintain EV charging equipment.

END OF SECTION

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SECTION 26 27 26
WIRING DEVICES

PART 1 – GENERAL

1.01 SCOPE OF WORK
A. The work under this section includes wall switches, receptacles, standalone occupancy sensors, device plates and box cover.

1.02 SECTION INCLUDES
A. Wall Switches
B. Receptacles
C. TV-Display Back Boxes
D. Device Plates and Box Covers
E. Cord Reel Assemblies

1.03 RELATED WORK
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.

1.04 SUBMITTALS
A. Provide product data showing model numbers, configurations, finishes, dimensions, and manufacturer's instructions.

1.05 OPERATION AND MAINTENANCE DATA
A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

PART 2 – PRODUCTS

2.01 GENERAL
A. Device Color: Light Almond

2.02 MODULARLY CONNECTED (MODULAR) DEVICES:
A. Modularly connected devices are allowed, but not required.
B. Use back and side wired devices in lieu of modular weather-resistant rated GFCI receptacles.
C. Modular Pigtailed Connector: Polarized connector with minimum six-inch stranded copper wire leads, polycarbonate right-angle housing, UL498 listed, with finger-safe connector housing which provides insulation from conductive surfaces. Contacts shall be brass. Connector shall be manufactured so that it provides a secure connection such that it will maintain contact with the device until the device is removed for replacement. Modular connectors shall be provided with covers which protect the contacts from paint, drywall mud, and construction dust and debris. Connectors shall be Cooper Arrow-Hart ArrowLink, Hubbell SNAPConnect, Leviton Lev-Lok, Pass & Seymour PlugTail, or approved equal.

2.03 WALL SWITCHES
A. Wall Switches for Lighting Circuits and Motor Loads Under 1/2 HP: Heavy duty use toggle switch, rated 20 amperes and 120/277 volts AC. Switches shall be UL20 Listed and meet Federal Specification WS-896. All switches shall be heavy duty Specification Grade with separate green ground screw. Provide single pole, three-way, four way and other configurations as noted on the drawings.
B. All switches shall be back and side wired, screw clamp type, suitable for solid or stranded wire up to #10 AWG, with separate green ground screw. Switches shall be Cooper Arrow-Hart 1221*, Hubbell 1221*, Leviton 1221-S*, Pass & Seymour CS20AC1-*, or approved equal. (* indicates color selection).
C. Handle: Made of nylon or high impact resistant material.
D. All switches on emergency or standby power circuits shall have a red handle with matching cover plate.

2.04 WALL DIMMERS

A. Compatible with the voltage of the circuit being controlled: 120V or 277V;
B. Compatible with the load being dimmed;
C. Paddle style switch with linear dimming slider located adjacent to paddle switch.
D. Separate ON/OFF switch: single-pole, 3-way, or multiple-location operation as indicated on the drawings;
E. No derating required in multi-gang applications;
F. Polycarbonate construction;
G. Line-voltage LED Dimmer: Forward or reverse phase dimming control as required for the application;
H. 0-10 V Dimmers: Ratings: 30 mA sink current;

2.05 WALL DIMMERS WITH INTEGRAL OCCUPANCY SENSOR

A. Paddle style switch with linear dimming slider located adjacent to paddle switch.
B. Combination PIR and 0-10V dimmer in common device.

2.06 RECEPTACLES

A. Duplex Convenience and Straight-blade Receptacles: NEMA Type 5-20R, nylon or high impact resistant face. Receptacles shall be UL498 Listed, comply with NEMA WD1, NEMA WD6 configuration 5-20R and meet Federal Specification WC-596. All duplex receptacles shall be heavy duty Specification Grade, 20 amp rated.
B. All receptacles shall be back and side wired, screw clamp type, suitable for solid or stranded wire up to #10 AWG, with a separate green ground screw. Receptacles shall be Cooper Arrow-Hart 5362*, Hubbell 5362*, Leviton 5362-S*, Pass & Seymour PS5362-*, or approved equal. (* indicates color selection).
C. Generally, all receptacles shall be duplex convenience type unless otherwise noted.
D. All receptacles installed in toilet rooms, kitchens or culinary lab space or within 6 feet of the outside edge of sinks, and in other damp or wet locations shall be GFCI type.
E. All receptacles installed in outdoor locations, garages, rooftops, and in other damp or wet locations shall be GFCI type with a weather-resistant (WR) rating.
F. GFCI Receptacles: Duplex convenience receptacle with integral ground fault current interrupter meeting the requirements of UL standard 943 Class A. GFCI receptacles shall be Cooper Arrow-Hart VGF20*, Hubbell GF20*L, Leviton N7899-*, Pass & Seymour 2095*, or approved equal.
G. GFCI Receptacles with a weather-resistant (WR) rating: Weather-Resistant duplex convenience receptacle with integral ground fault current interrupter meeting the requirements of UL standard 943 Class-A. WR GFCI receptacles shall be Cooper Arrow-Hart WRVGF20*, Hubbell GFR5362*TR, Leviton WR899-*, Pass & Seymour 2095TRWR*, or approved equal.
H. USB Charger Receptacles: Duplex convenience receptacle with dual, integral USB charging ports. USB charger receptacles shall be Cooper Arro-Hart TR7746*, Hubbell USB20X2*, or approved equal.
I. All receptacles on emergency and standby power circuits shall have a red face with matching cover plate.

2.07 TV – DISPLAY BACK BOXES

A. TV Receptacles shall be part of integral AV back box device. Chief Large In-Wall box with white flange cover. PAC526FCW. Coordinate AV connection with faceplate/jack details on drawings.
B. Overall Dimensions (H x W x D)14.25" x 14.25" x 3.9"

2.08 DEVICE PLATES AND BOX COVERS

A. Decorative Cover Plate:
   1. General Areas - Smooth thermoplastic nylon. Light Almond
   2. Mechanical Rooms – Galvanized steel.
B. Plate securing screws shall be metal with color to match plate finish.
C. Weatherproof Cover Plate: Gasketed metal with hinged device covers.
D. While in Use Cover: UL Listed outdoor die-cast hinged cover with integral lock tab. Intermatic extra heavy duty in-use cover or similar.
E. Surface Cover Plate: Raised galvanized steel.

2.09 CORD REEL ASSEMBLIES

A. Description: Heavy duty power cord reel with pre-wired portable outlet box assembly with (2) 20A GFCI duplex receptacle in common box.
B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Reelcraft
   2. Cox Reels
   3. Hubbell
C. Construction:
   1. 120V – 20A
   2. UL Listed
   3. 12/3 SO Cord, Cord length 25 feet.
   4. Cord End: NEMA 5-20 GFCI Devices. Dual duplex, Back to back mounting
   5. Inlet Cord / Feed Input Cable: NEMA Twist lock plug with corresponding twist lock receptacles installed flush in ceiling tile adjacent to reel assembly.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install wiring devices at heights shown on Contract Drawings.
B. Install devices and wall plates flush and level.
C. Receptacles shall have a bonding conductor from grounding terminal to the metal conduit system. Self-grounding receptacles using mounting screws as bonding means are not approved.
D. Oversized or extra deep cover plates not acceptable. Repair wall finishes and remount outlet box when standard device plates do not fit flush or do not cover rough wall opening.
E. Coordination with Other Trades:
   1. Take steps to ensure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
   2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
   3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
   4. Install wiring devices after all wall preparation, including, painting, is complete.
F. Conductors:
   1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
   2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
   3. The length of free conductors at outlets for devices shall meet provisions of NPFA 70, Article 300, without pigtails.
   4. Existing Conductors:
      a. Cut back and pigtail, or replace all damaged conductors.
      b. Straighten conductors that remain and remove corrosion and foreign matter.
      c. Pigtailing existing conductors is permitted provided the outlet box is large enough.
G. Device Installation:
   1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
   2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
   3. Do not remove surface protection, such as plastic film and smudg4e covers, until the last possible moment.
   4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
   5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductors tightly clockwise, 2/3 to ¾ of the way around terminal screw.
   6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
   7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.

8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

3.02 FIELD QUALITY CONTROL

A. Inspect each wiring device for defects.
B. Operate each wall switch and sensor with circuit energized and verify proper operation.
C. Verify that each receptacle device is energized.
D. Test each receptacle device for proper polarity.
E. Test each GFCI receptacle device for proper operation.

3.03 ADJUSTING

A. Adjust devices and wall plates to be flush and level.
B. Mark all conductors with the panel and circuit number serving the device with a machine generated label, at the device, and on the back of the device cover.

3.04 TESTING

A. Tests for Convenience Receptacles:
   1. Line Voltage: Acceptable range is 105 to 132 V.
   2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
   3. Ground Impedance: Values of up to 2 ohms are acceptable.
   4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
   5. Using the test plug, verify that the device and its outlet box are securely mounted.
   6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

END OF SECTION

SECTION 26 27 28
DISCONNECT SWITCHES

PART 1 - GENERAL

1.01 SCOPE OF WORK
A. The work under this section includes disconnect switches and enclosures.

1.02 SECTION INCLUDES
A. Disconnect Switches

1.03 RELATED WORK
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this section.

1.04 SUBMITTALS
A. Include outline drawings with dimensions, and equipment ratings for voltage, ampacity, horsepower, and short circuit.

1.05 OPERATION AND MAINTENANCE DATA
A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

1.06 PROJECT COORDINATION
A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
B. Disconnect switch manufacturer shall be the same manufacturer as switchboards, distribution panelboards, branch circuit panelboards and motor starters.

PART 2 – PRODUCTS

2.01 DISCONNECT SWITCHES
A. Nonfusible Switch Assemblies: UL 89 and NEMA KSI, horsepower rated Type HD Heavy Duty; quick-make, quick-break, load interrupter, enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position.
B. Enclosure: NEMA 1 or NEMA 3R as indicated on Drawings.
C. Provide manufacturer's equipment ground kit in all disconnect switches.
D. Provide internally mounted neutral bar where used with 4 wire circuits.
E. Provide UL Listed service rating where required.

PART 3 – EXECUTION

3.01 INSTALLATION
A. Install disconnect switches where indicated on Drawings.
B. Provide identification as specified in Section 26 05 53.

END OF SECTION

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SECTION 26 31 00
PHOTOVOLTAIC POWER SUPPLY SYSTEM

PART 1 GENERAL

1.01 SCOPE OF WORK

1. Alternate Bid: Work under this section includes panels (modules), mounting, and inverters.
2. Provide design, furnishing and installation of a complete photovoltaic power supply system.

1.02 REFERENCES

A. Codes and standards referred to in this Section are:
1. 2014 National electrical Code
2. IEC-61215
5. ANSI 62.41
6. IEEE 519
7. IEEE 929
8. IEEE 1547
9. ISO 9001
10. UL Inc. 1703
11. UL 1743
12. UL 1741 10
13. UL-508A

1.03 DEFINITIONS

A. PVSI: Photovoltaic System Integrator. The PVSI has full responsibility for the, design, submittals, construction, installation, testing, commissioning and implementation of the Photovoltaic System including all control, monitoring and Internet reporting of system operation.

B. PTC: PV USA Test Conditions. A set of reference photovoltaic device measurement conditions consisting of solar irradiance of 1 k WI m2, air mass of 1.5, 20°C ambient temperature at 10 meters above ground level and a wind speed of 1 meter per second.

C. NOCT: Normal Operating Cell Temperature. The temperature at which the cells in a photovoltaic module operate under standard operating conditions (SOC). These conditions are: irradiance of 0.8 kW/m2, 20°C ambient temperature, and average wind speed of 1 m/s, with the cell or module in an electrically open circuit state, the wind oriented parallel to the plane of the array, and all sides of the array fully exposed to the wind.

D. STC: Standard Test Conditions. A set of reference photovoltaic device measurement conditions consisting of solar irradiance of 1 kW/m2, air mass of 1.5, and 25°C cell temperature.

1.04 SYSTEM DESCRIPTION

A. Design Requirements:
1. Provide the corresponding necessary inverters. Utilize identical, individual photovoltaic modules mounted on ballasted rack systems on the facility roof, connected in series to form photovoltaic strings, which are connected in parallel to form photovoltaic arrays. Provide all required mounting racks and accessories, optimizers, inverters, wiring systems, grounding, testing and control and monitoring systems.

B. Performance Requirements
1. Solar Power Capacity of the Installed System:

a. East Roof Alternate Bid - Minimum 100.00 kW peak DC
b. West Roof Alternate Bid - Minimum 60.00 kW peak DC

2. Module Characteristics:
   a. Minimum module efficiency of 20% at STC,
   b. 85 percent of the specified Minimum Peak Power for a period of 25 years
   c. Minimum Peak Power rating of 450 watts minimum at STC.
   d. PERC Technology
3. Module Racks
   a. Fixed-pitch array racks shall be approved by the module manufacturer and together with the foundation system will be certified by an Illinois-licensed structural engineer to meet local wind codes or at least minimum sustained wind speeds of 90 mph.
   b. Flat roof installation with 10-degree tilt and ballasted mounting system.
4. Inverters
   a. Utility interactive transfromerless. UL Listed with integrated arc fault protection and rapid shutdown from compliance with NEC 2017.
   b. CEC weighted minimum efficiency of 98%
   c. Incorporates compatible module-level power optimizers.
5. Metering, Monitoring and Dashboard
   a. Web based interface
   b. Revenue grade metering with PV yield, building load and consumption.
   c. Customizable dashboard displayed on flat panel monitor within building.

C. Electrical Requirements:
1. All equipment to be UL Inc. Listed
2. System shall be compliant with NEC 2017 including all rapid shutdown requirements.
3. Connect individual modules in series to form a string per NEC requirements including temperature corrections.
4. Provide inverters with circuit input combiner. The output of each inverter is to be a regulated voltage that is coordinated to the design voltage of the modules and strings on the DC side of the system, three-phase four-wire.
5. Provide insulated copper conductors. Modular PV wiring system shall transition to building wiring in roof level junction boxes. All wiring from the individual junction boxes to the inverters will be insulated and installed in conduit as required by NEC.
6. Wiring for the series connections from individual modules to adjacent modules on the same mounting rack and may be installed without conduit. Utilizing color-coded black, white and green type rated cable. Utilize black UV rated plastic wire ties at not more than twelve inch spacing to support this wiring from mounting racks. All module series connection wiring that is not to an adjacent module but is to a module or connection on the same mounting rack is to be run within recessed channels in the mounting racks and secured at a spacing of not more than twelve inches with black UV rated plastic wire ties. Install all wiring in conduit for cables that extend beyond a mounting rack.
7. Transition to roof exposed conduit on roof as required.
8. In every conduit provide an insulated "system”-grounding cable sized in accordance with the Article 690.41 of the NEC.
9. Provide equipment-grounding conductors sized In accordance with the Article 690.43 of the NEC.
10. Limit total voltage drop of the wiring systems (total of DC and AC wiring from field combiner box to interconnection point in building switchgear) to less than 3%. Limit the voltage drop of each of the DC or AC wiring systems to less than 2%.

11. Ensure that at the highest expected ambient and cell temperatures the string voltage—after DC voltage drop to the inverter is considered-is above the bottom end of the MPPT window of the corresponding inverter. Provide the calculations, based on 20 years of depreciated module performance at the maximum rate of degradation specified herein.
12. Ensure that the inverter AC output circuit does not have excessive voltage drop that would cause the inverters to reach the high voltage limit, cause a high-voltage trip and the inverter to go offline with a “high grid voltage” error.

1.05 SUBMITTALS

A. General:
   1. Provide all submittals, including the following, as specified in the Scope of Services

B. Design:
   1. Submit for review and approval the detailed design of the photovoltaic system with sufficient information to determine conformance with these specifications. Include the following:
      a. Provide calculations demonstrating voltage and amperage of each series and parallel connection of modules, panels and arrays.
      b. Provide calculations of solar availability at the proposed site along with proposed location and dimensions of the solar array. Base the solar availability calculations shall be based on measured shading at the site.
      c. Perform projected annual energy production calculations for total peak wattage and peak and annual kilowatt-hour output of the system based on PTC, measured solar availability, installation location, angle of installation, number and efficiency of proposed modules and number and efficiency of proposed inverters, voltage drop, estimated module performance degradation and effect of dirt accumulation after one year.
      d. Provide calculations for all wire and conduit sizing including voltage drop calculations for the DC and AC wiring.
      e. Provide a detailed block diagram of proposed system showing; modules, panels, arrays, disconnect switches, inverters, circuit combiners, inverters and connections.
      f. Provide Manufacturers Calculations based on module weight and wind loading for mounting rack sizes, connections and loading.
      g. Provide Attachment and anchoring details for rack connections to roof structure for anchored PV systems and module connections to rack.
      h. Provide Electrical one-line diagram of proposed system. Showing system and equipment grounding system diagrams.
      i. Provide Calculations to verify sizing of all electrical protective devices such as fuses and breakers.
      j. Provide information control, monitoring and Internet reporting system architecture, I/O naming convention and lists, display screens, reports and security methods.

C. Provide Product Data and Information: Provide standard manufacturer's specification data on photovoltaic modules, circuit combiners, disconnect switches, inverters, meters, racks, wiring, wire ways, grounding elements and individual components. Data to include materials of manufacturer, finishes, standard dimensions and weights, mounting requirements including mounting bolt spacing and wire way locations, physical properties, rating data and Listings and Certifications.

D. Shop Drawings:

1. Photovoltaic Modules: Provide drawings detailing electrical terminations, connection diagrams, mounting details and cleaning and maintenance requirements. Also provide specific data on individual solar module materials, connections, efficiency, electrical performance including warranties.
2. Support Racks and Foundations: Provide drawings stamped by licensed professional engineers detailing component dimensions, module mounting arrangements and mounting hardware, method of securing racks to the ground, grounding and calculations for loading including wind loading.
3. Array Location: Provide drawing showing exact location of the array that will produce the calculated annual energy use.
4. Circuit Combiners: Provide drawings detailing internal and external views, identification of all components, component dimensions, rating data of enclosures and of all components and nameplate data.
5. Disconnect Switches: Provide drawings detailing internal and external views, rating data of enclosures and of all components and nameplate data.
6. Inverters: Provide detailed drawings showing internal and external views with dimensions and identification of all components, wiring diagrams of all internal and external connections, rating data of all components, efficiency of inverters, and safety and electrical protection devices and nameplate data.
7. Wiring: Provide detailed physical drawings showing location and dimensions of all wiring, mounting of wiring and wire ways, termination details and labeling system for all wiring.

E. Quality Control & Commissioning: Provide all required and specified test reports, certificates, and evidence of manufacturer's experience. Provide all proposed test and commissioning procedures for review and approval prior to beginning any tests. Commissioning shall include but not be limited to: comparison of measured and predicted power; spot measurement of I-V curves for 5% of the modules, 10% of the strings distributed evenly among the array rows and for each inverter; log of torque measurement at electrical connections; infra-red scan of critical components and junctions.

F. Operation and Maintenance Manuals: Provide operation and maintenance manuals, as specified in part d shop drawings. Provide specific information on photovoltaic module
cleaning, maintenance and testing procedures and inverter troubleshooting, calibration, testing and maintenance procedures.

1.06 QUALITY ASSURANCE

A. Regulatory Requirements: All components are to be UL Inc. Listed and modules and inverters are to be certifiable under the applicable Electric Code

B. Experience Requirements - Photovoltaic System Integrator (PVSI): The PVSI must have demonstrated experience in the integration of at least three photovoltaic systems of 40 KW or larger in size and arrangement similar to that specified. Provide verification and certification of required experience.

C. Experience Requirements - Equipment: Provide photovoltaic modules from a manufacturer that has manufactured modules of the type specified for at least three (3) years. Provide inverters from a manufacturer that has manufactured inverters of the type specified for at least three (3) years. Provide verification and certification of required experience.

1.07 DELIVERY, STORAGE AND HANDLING

A. General: Deliver, store and handle all products and materials as specified by the manufacturer

B. Provide any special instructions for storage of spare photovoltaic modules

C. If recommended by the photovoltaic module supplier, provide storage racks for spare modules.

1.08 SEQUENCING AND SCHEDULING

A. Coordinate all work with the requirements of other trades work under this contract.

1.09 WARRANTY

A. Warrant that each PV module shall be free from defects in materials and workmanship for a period of ten (10) years from date of installation.
B. Warrant that each PV module shall provide a minimum of 80 percent of the specified Minimum Peak Power for a period of twenty-five (25) years from the date of installation.
C. Warrant each inverter for twelve (12) years from the date of installation.
D. Warrant the Labor and Workmanship of the entire photovoltaic power supply system for a period of two (2) years.
E. Warrant all other equipment, including optimizers and installation hardware components for 25 years.

1.010 SPARE PARTS

A. General: Furnish the following spare parts, packaged for long-term storage with easily identifiable labels on each package.
   1. 1% photovoltaic modules
   2. 1% photovoltaic module and string connectors (male and female)
   3. Two (2) complete replacement sets of fuses for each inverter

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following: (Other manufacturers of equivalent products may be submitted for review and approval.)
   1. Photovoltaic Modules
      a. CanadianSolar
      b. Hanwha
      c. Heliene
      d. Vsun
      e. Sunpower
      f. Panasonic
      g. LG
   2. Inverters:
      a. Fronius
      b. Solaredge
      c. SMA
      d. Yasakawa / Solectria Solar
   3. Module Mounting Racks
      a. Iron Ridge
      b. Unirac

2.02 PHOTOVOLTAIC MODULES

A. General: Provide photovoltaic modules designed to meet the specified requirements.
B. Provide Modules with the following characteristics:
   1. Monocrystalline or Polycrystalline cells Tier 1 rated with PERC Technology
   2. Minimum conversion efficiency of 20.0 percent

3. Output power rating must be positive tolerance only
4. Minimum peak power ratings of 450 watts (+/- 10W) at STC
5. Modules have all factory-installed MC4 connectors

C. Provide modules specifically designed for outdoor, rack mounted installations.
D. Each module is to have weatherproof insulated cable and connectors
E. Provide each module with an anodized aluminum frame, predrilled for mounting.
F. Provide module level power optimizers compatible with inverter system.

2.03 PHOTOVOLTAIC MODULE MOUNTING RACKS

A. Provide mounting racks specifically designed for mounting photovoltaic modules in an inclined position.
B. Rack system to be stainless steel, galvanized steel or aluminum.
C. Ballasted systems with flat roof attachments.
D. Racks shall be fixed 10-degree tilt.
E. All fasteners and mounting hardware are to be from the same manufacturer as the rack system and of material recommended by the rack system manufacturer.
F. Provide a continuous equipment grounding system for all racks with screw type connections to each rack and to each photovoltaic module. Connect equipment ground systems directly to the building main ground system bus.
G. UL 2703 compliant

2.04 INVERTERS

A. Provide grid connected inverters specifically designed for photovoltaic systems, sized as shown to be a roof mounted application.
B. Inverter to meet IEEE 519 for total harmonic distortion
C. Design of inverters rated for the dc voltage from the photovoltaic array with the following features and components:
   1. Transformerless
   2. Internal, input parallel combiner
   3. DC fuses for each string in integrated combiner box / DC disconnect.
   4. No-load break input dc disconnect switch.
   5. DC rated input contactor for back feed protection
   6. DC surge and fault protection
   7. Three phase, 480V
   8. AC-volt rated output contactor
   9. Pre-charge circuit to minimize in-rush current and nuisance trips
   10. AC surge protection
   11. AC-volt rated output circuit breaker
   12. Arc fault circuit interruption, NEC 2017 compliant
   13. Integrated control system with RS 485 Modbus communications
   14. Provide a Revenue grade meter integral to the inverter, or as 3rd party monitoring system.
   15. Rapid shutdown compliant, NEC 2017 compliant.
D. Interior Inverters to be furnished in a minimum NEMA 3R enclosure
E. Inverter to comply with UL 1741, IEEE 929, IEEE 1547, IEEE 519 and ANSI 62.41
F. Inverter to have CEC weighted efficiency rating of at least 98%
G. Provide provisions for mounting inverter to the wall.

2.05 WIRING AND WIREWAYS

A. Provide all interconnecting wiring and wire ways as specified below
B. All wiring for the photovoltaic system is to be insulated per NEC. Conductors are to be sized to limit voltage drop to the inverter input to less than 2 percent. Conductor sizing is to also consider NEC requirements for temperature and number of current

carrying conductors in a raceway.

C. Conduits within the building are to be installed in, EMT where not subject to Physical Damage. Utilize GRS conduit where subject to physical damage.

D. Conduits outside the building are to be installed in, GRS where not subject to Physical Damage. Utilize GRS conduit where subject to physical damage.

E. Provide labeling for each conduit, each wire and each wireway.

2.06 OPERATION, MONITORING AND CONTROL

A. Solar Electric Monitoring System may include the following:
   1. 24x7 monitoring service
   2. Web-based views showing how the solar electric system is operating.
   3. Automatic calculation of reduction in greenhouse gas emissions
   4. Automatic email alerts to your system installer or maintenance service provider
   5. Communications via locations Internet broadband link
   6. Online storage of data and system information, hosted at a data center
   7. Metering and reporting for tracking building energy use and total generated renewable energy suitable for quantifying Performance- Based Incentives such as Renewable Energy Credits (REC)

B. Electrical demand measurement

C. Internet-based communications

D. Provide metering at main switchboard to input demand and usage into PV monitoring system.

PART 3 - EXECUTION

3.01 PREPARATION

A. The Installation of the photovoltaic power supply systems must be coordinated with other work done under this Contract. Provide a detailed schedule of all activities as required,

B. Review activities and work schedules of other work on the site.

C. Coordinate site specific information

3.02 INSTALLATION

A. General: Install the photovoltaic power supply systems in accordance with the manufacturer's recommendations and approved shop drawings and as specified

B. Coordinate all work with all other work on the site.

C. Wiring and wire ways
   1. Utilize integral wiring and connectors provided with photovoltaic modules for series connection wiring from individual photovoltaic modules to adjacent modules. Secure this wiring to modules and mounting rack systems with black UV rated plastic wire ties at distances not greater then every twelve inches.
   2. Provide up to 1000-volt insulated, copper conductors in conduit for all parallel connections from series connected panel groups to circuit combiners Size conductors for 156 percent of peak current calculated for the circuit.
   3. Provide galvanized steel conduit for all interior exposed conduit. Secure exposed conduit to mounting racks with approved conduit clamps at distances not greater then every three feet. Provide up to 1,000-volt insulated, copper conductors in conduit for all connections between circuit combiners. Provide rigid galvanized steel conduit for all exterior exposed conduit subject to damage. Secure exposed conduit to mounting racks with appropriate straps or clamps at distances not greater then every three feet.
   4. Size conductors for 156 percent of peak current calculated for the circuit.

5. Provide labels for all conductors, conduits, modules, boxes and inverters as required by Specifications.

D. Provide complete grounding systems as per Articles 250 and 690 of the NEC

E. Inverters:
1. Provide all mounting hardware.
2. Install in the locations as shown on the drawings.
3. Furnish, install and terminate all wiring and wire ways for all connections.
4. Provide complete grounding system Per Articles 250 and 690 of the NEC.

3.03 FIELD QUALITY CONTROL

A. Tests: After installation of the complete system and before connection to the unit substation, provide a test of the system todemonstrate:
1. Proper connection of allcomponents
2. kW output of system is as required by thesespecifications
3. All controls and monitoring functioncorrectly
4. All protective devices functioncorrectly

B. Submit for approval the test procedure prior to beginning these tests.

C. Provide all equipment necessary to conduct all tests.

D. If necessary, for the proper operation of the system during testing, provide for temporary connections to the buildings electrical system.

E. Provide for connections to the Internet to demonstrate the on-line monitoring features of the control and monitoring system.

3.04 COMMISSIONING AND OPERATION DEMONSTRATION

A. Perform a complete system commissioning record of all measured data, findings and recommendations.

B. Furnish the services of a qualified representative of the PVSI to demonstrate the proper operation and instruct the owner’s staff on the equipment's operation and maintenance, as specified herein.

3.05 TRAINING

A. Following complete installation and field-testing; provide training in the operation, troubleshooting and maintenance of the equipment as specifiedin This Section.

END OF SECTION

SECTION 26 43 13
SURGE PROTECTIVE DEVICES FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 – GENERAL

1.01 SCOPE OF WORK
A. The work under this section includes Surge Protective Devices (SPD) as indicated on the project drawings and electrical diagrams.

1.02 SECTION INCLUDES
A. Surge Protective Devices (SPD)

1.03 RELATED WORK
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.

1.04 SUBMITTALS
A. Include all SPD data necessary to show device is in compliance with all product specifications. Include product data sheets which show the device dimensions, weight, connections, and mounting requirements, along with installation instructions.
B. Provide verification the SPD is listed or recognized through Underwriters' Laboratories to the latest safety standards ANSI/UL 1449.

1.05 REFERENCE STANDARDS
A. UL 1449, Third Edition – Standard for Safety for Surge Protective Devices.
B. ANSI/IEEE C62.41.1 Guide on the Surge Environment in Low-Voltage AC Power Circuits.
C. ANSI/IEEE C62.41.2 Recommended Practice on Characterization of Surges in Low-Voltage AC Power Circuits.
D. ANSI/IEEE C62.45 Recommended Practice on Surge Testing for Equipment Connected to Low Voltage AC Power Circuits.
E. IEEE C62.62 Standard Test Specification for Surge Protective Devices for Low-Voltage AC Power Circuits.
F. ANSI/UL 1283 – Standard for Electromagnetic Interference Filter.
G. Military Standard 220C
H. NFPA 70, NEC Article 285

1.06 QUALITY ASSURANCE
A. The manufacturer shall have been in the Surge Protective Device industry for a minimum of 5 years.

1.07 WARRANTY
A. The manufacturer shall provide a minimum of 10 years warranty from the date of shipment of the SPD.

1.08 OPERATION AND MAINTENANCE DATA
A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

PART 2 – PRODUCTS

2.01 SURGE PROTECTIVE DEVICES (SPD)
A. The Surge Protective Device (SPD) shall be suitable for use on service entrances (ANSI/IEEE Standard C62, Category C environments). The SPD shall be connected in parallel with the facility's electrical system.

B. SPD shall be listed in accordance with UL 1449, Third Edition and correctly labeled as a Type 1 or Type 2 SPD for its application. All SPDs installed on the line side of the service entrance OCPD shall be of Type 1. All SPDs installed on the load side of the service entrance OCPD shall be either Type 1 or Type 2.
C. Type 2 SPDs shall be co-listed to UL1283.
D. The SPD shall be made up of metal oxide varistors (MOVs), selenium cells, silicon avalanche diodes, or a combination thereof, ensuring that all of the performance requirements are met. Gas tubes shall not be used. The entire unit shall be enclosed in a metal or ABS enclosure, NEMA rated for the location. The SPD may be mounted external or integral to the piece of equipment. SPDs installed integral to the equipment shall be of the same manufacturer of the equipment.
E. The SPD shall have a maximum continuous operating voltage (MCOV) rating of not less than 115% of nominal voltage of the system it is protecting.
F. The SPD will provide all modes of protection (L-N,) (L-G), (N-G) for wye configured systems. For a delta configured system, the device shall have line to line (L-L) and line to ground (L-G) protection modes.
G. The SPD shall have a voltage protection rating (VPR) as assigned by UL 1449, Third Edition, which shall not exceed the following:
   1. 800V for L-N, L-G, N-G modes, 1200V for L-L in 120/208V wye system.
H. The SPD shall have surge current capability of 100 kA (minimum) per Mode, or 200kA (minimum) per Phase.
I. The SPD shall nave a Nominal Discharge Current Rating (In) or not less than 20kA.
J. The SPD shall have a Short Circuit Current Rating (SCCR) of not less than 200kA.
K. Each SPD shall include externally-mounted LED visual status indicators that indicate the on-line status of the unit for each phase.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install SPD devices in accordance with manufacturer's written instructions, applicable requirements of NEC and NEMA standards, and recognized industry practices.
B. The SPD units shall be installed at the locations shown on the drawings, or as indicated in the one-line diagram. They shall be parallel-connected to, and located adjacent to the switchboard or panelboard being protected. Locate as close as practical to the neutral bus, keeping lead length as short as possible (less than 5 feet preferred). SPD devices shall be connected through a multi-pole circuit breaker or fused disconnect switch, not into main lugs. Circuit breaker or fused disconnect switch shall be 60A minimum for main service device, 30A minimum for branch panelboard device or as recommended by the manufacturer (whichever is larger). Use schedule 40 PVC conduit between the SPD device and the switchboard or panelboard. To connect the SPD device to the circuit breaker or disconnect switch, use conductors appropriately sized or the manufacturer’s recommended conductors (whichever is larger). Avoid sharp bends, excess length, and splices in the wires (where possible, use a close-nippled connection with wires going directly to a circuit breaker within the switchboard or panelboard).
C. Setup and test per the manufacturer's recommendations.

3.02 TRAINING

A. See Section 26 05 00 for general training requirements.

END OF SECTION

SECTION 26 51 13
INTERIOR LIGHTING FIXTURES, LAMPS, AND BALLASTS

PART 1 – GENERAL

1.01 SCOPE
A. The work under this section includes interior luminaires and accessories, exit signs, lamps, and ballasts. Included are the following topics:

1.02 RELATED WORK
A. Applicable provisions of Division 1 govern work under this Section.
B. Section 26 27 26 - Wiring Devices
C. Section 26 09 23 Lighting Controls

1.03 REFERENCE STANDARDS
A. RoHS - Restriction of Hazardous Substances. Council of the European Union (EC) Directive 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment.
B. LM-79-08 (or latest) - IES Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products.
C. LM-80-08 (or latest) - IES Approved Method for Measuring Lumen Maintenance of LED Light Sources.
D. TM-21-11 (or latest) - IES Technical Memorandum on Projecting Long Term Lumen Maintenance of LED Light Sources.
E. NEMA SSL 1-2010 (or latest) - Electronic Drivers for LED Devices, Arrays, or Systems.

1.04 DEFINITIONS
A. Driver - the power supply used to power LED luminaires, modules, or arrays.
B. L70, L70, or L70% - The reported life of an LED component or system to reach 70% lumen maintenance, or 70% of the LED's original light output. This test is being developed by the IES and is currently described by TM-21-11.
C. LED's - Broadly defined as complete luminaire with light emitting diode (LED) packages, modules, light bars or arrays, complete with driver.
D. LED luminaire failure - Negligible light output from more than 10 percent of the LED's constitutes luminaire failure.

1.05 SUBMITTALS
A. Include outline drawings, lamp and ballast data, support points, weights, accessory information and performance data for each luminaire type.
B. Luminaires with unique mounting elements such as illuminated corners or non-typical mounting installations such as recessed in a vertical wall, shall have a project specific factory shop drawing submitted.
C. For each luminaire type, submit luminaire information including catalog cuts with highlighted catalog numbers and required accessories:
- Luminaire:
  - Manufacturer and catalog number.
  - Type (identification) as indicated on the plans and schedule.
- Ballast:
  - Manufacturer and catalog number.
  - Type (Programmed Start, etc.), Ballast Factor, THD, etc.
  - Quantity per luminaire.
- Lamps:
  - Manufacturer, catalog number, and wattage
  - Quantity per luminaire

1.06 OPERATION AND MAINTENANCE DATA
A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

1.07 EXTRA MATERIAL

A. Provide three (3) percent of each lamp type, but not less than one (1) of each type.
B. Provide one (1) of each type of LED module, light bar, or array (if applicable). If the LED's are integrated into the luminaire and are not separate components, then extra LED's are not required.
C. Provide one (1) ballast of each type. This includes LED drivers.

PART 2 - PRODUCTS

2.01 INTERIOR LUMINAIRES AND ACCESSORIES

A. See the Luminaire Schedule on the drawings for type of luminaires and catalog numbers. Catalog numbers are shown on the drawings for quality and performance requirements only. Luminaires manufactured by others are equally acceptable provided they meet or exceed the performance of the indicated luminaires, and meet the intent of the design.
B. Luminaire shall be certified by a Nationally Recognized Testing Laboratory (UL, ETL, or IEC).
C. Provide all luminaires with quick-connect disconnecting means, similar to Thomas & Betts Sta-Kon.

2.02 LED LUMINAIRES

A. LED Luminaires shall meet all DesignLights Consortium® (DesignLights.org) Product Qualification Criteria. This does not require that the luminaire be listed on the DesignLights Consortium's® Qualified Products List, but they must meet the Product Qualification Criteria. The technical requirements that the luminaire shall meet for each Application Category are:
   1. Minimum Light Output.
   2. Zonal Lumen Requirements.
   3. Minimum Luminaire Efficacy.
   4. Minimum CRI.
   5. L70 Lumen Maintenance.
   6. Minimum Luminaire Warranty of 5 years (not pro-rated) to include LED driver and all LED components.
B. Color Temperature As listed in the Luminaire Schedule on the plans.
C. Color Consistency: LED manufacturer shall use a maximum 3-step MacAdam Ellipse binning process to achieve consistent luminaire-to-luminaire color for interior luminaires. Exterior luminaires shall use a maximum 5-step MacAdam Ellipse binning process.
D. Glare Control: Exterior luminaires shall meet DesignLights Consortium's® criteria for Zonal Lumen Distribution requirements or Backlight-Uplight-Glare (BUG) standards for exterior luminaires.
E. Luminaire shall be mercury-free, lead-free, and RoHS compliant.
F. Luminaire shall comply with FCC 47 CFR part 15 non-consumer RFI/EMI standards.
G. Light output of the LED system shall be measured using the absolute photometry method following IES LM-79 and IES LM-80 requirements and guidelines.
H. Luminaire shall maintain 70% lumen output (L70) for a minimum of 50,000 hours.
I. Lumen output shall not depreciate more than 20% after 10,000 hours of use.
J. Luminaire and driver shall be furnished from a single manufacturer to ensure compatibility.
K. Luminaire Color Rendering Index (CRI) shall be a minimum of 80 for interior luminaires, and a minimum of 70 for exterior luminaires.
L. LED luminaire shall be thermally designed as to not exceed the maximum junction temperature of the LED for the ambient temperature of the location the luminaire is to be installed. Rated case temperature shall be suitable for operation in the ambient temperatures typically found for the intended installation. Exterior luminaires to operate in ambient temperatures of -20°F to 122°F (-29°C to 50°C).
M. Luminaire shall operate normally for input voltage fluctuations of plus or minus 10 percent.
N. Luminaire shall have a maximum Total Harmonic Distortion (THD) of 20% at full input power and across specified voltage range.
O. All connections to luminaires shall be reverse polarity protected and provide high voltage protection in the event connections are reversed or shorted during the installation process.
P. All luminaires shall be provided with knockouts for conduit connections.
Q. The LED luminaire shall carry a limited 5-year warranty minimum for LED light engine(s)/board array, and driver(s).

R. Provide all of the following data on submittals:
   1. Delivered lumens
   2. Input watts
   3. Efficacy
   4. Color rendering index.

S. LED Luminaires used for Emergency Egress Lighting:
   1. The failure of one LED shall not affect the operation of the remaining LEDs.

2.03 LED DRIVERS

A. General:
   1. Provide driver type (non-dimmed, step-dimmed, continuous-dimming, etc.) as indicated on the luminaire schedule on the drawings.
   2. Minimum Warranty of 5 years (not pro-rated) to include LED driver and all LED components.
   3. Driver shall have a rated life of 50,000 hours, minimum.
   4. Driver and LEDs shall be furnished from a single manufacturer to ensure compatibility.
   5. Driver shall have a minimum power factor (pf) of 0.9 and a maximum crest factor (cf) of 1.5 at full input power and across specified voltage range.
   6. Driver shall operate normally for input voltage fluctuations of plus or minus 10 percent.
   7. Driver shall have a maximum Total Harmonic Distortion (THD) of 20% at full input power and across specified voltage range.
   8. Wiring connections to LED drivers shall utilize polarized quick-disconnects for field maintenance.
   9. Fuse Protections: All luminaires shall have built-in fuse protection. All power supply outputs shall be either fuse protected or be Polymeric Positive Temperature Coefficient (PTC)-protected as per Class 2 UL listing.
   10. Provide all of the following data on submittals:
   11. Input watts
   12. Power Factor (pf)
   13. Crest Factor (cf) at full input power
   14. Total Harmonic Distortion (THD).

B. Dimming Drivers:
   1. LED driver shall be compatible with dimming controls where dimming is indicated on the plans. Dimmable drivers shall use Dimming Constant Current (DCC) or Pulse Width Modulation (PWM) operation.
   2. Step-Dimming Drivers: Easily switched from 0% to 50% to 100% output power. Both switch-leg inputs shall control 50% of the luminaire's light output equally.
   3. Continuous Dimming Drivers: LED luminaires shall dim to (20%, 15%, 10%, 5%, or 0.1%) as specified in the Luminaire Schedule on the plans without visible flicker or "popcorn effect". "Popcorn effect" is defined as the luminaire being on a pre-set dimmed level (less than 100%), and going to 100% prior to returning to the pre-set level when power is returned to the luminaire. Continuous Dimming Drivers shall use 0-10V control.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Verify ceiling types with Architectural plans or with existing ceilings. Verify specified luminaires are compatible with specified ceiling type(s) prior to ordering luminaires.
B. Install in accordance with manufacturer's instructions.
C. Install suspended luminaires using aircraft cable, or pendants supported from swivel hangers. Heavy duty chain supports may be used where indicated on the luminaire schedule. Provide aircraft cable, pendants, or chain lengths required to suspend luminaire at indicated height. All aircraft cables or pendant supported luminaires shall have an independent support to structure at all cable or pendant support locations. When chain is used, tie-wrap the luminaire whip to the chain.
D. Support luminaires larger than 2 x 4 foot (600 x 1200 mm) size independent of ceiling framing.
E. Provide independent support for all luminaires over 50 lbs.
F. Locate ceiling luminaires as indicated on reflected ceiling plan.

G. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prohibit movement.
H. The Contractor shall install luminaire supports as required. Luminaire installations with luminaires supported only by insecure boxes will be rejected. It shall be the Contractor's responsibility to support all luminaires adequately, providing extra steel work for the support of luminaires if required. Any components necessary for mounting luminaires shall be provided by the Contractor. No plastic, composition or wood type anchors shall be used.
I. Install recessed luminaires to permit removal from below.
J. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.
K. Install code required hardware to secure recessed grid-supported luminaires in place.
L. Install wall mounted luminaires and exit signs at height as scheduled. Use pendants supported from swivel hangers in exposed ceiling/structure locations where necessary to mount exit signs at the specified height.
M. Install accessories furnished with each luminaire.
N. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.
O. Bond luminaires and metal accessories to branch circuit equipment grounding conductor.
P. Install specified lamps in each luminaire and exit sign.
Q. Dimmed luminaire circuits shall have separate neutrals.
R. Dimmed LED luminaires shall have a positive OFF, which requires turning off the circuit to the luminaire so that the luminaires don't "glow" at the lowest dimmed setting. This shall be accomplished using a switch, relay, or some other means acceptable to A/E.

3.02 ZERO-TO-10V DIMMING CONTROL WIRING INSTALLATION

A. Zero-to-10V dimming control conductors are classified by the NEC as Class 2 conductors and shall be kept separate from line-voltage conductors per NEC 725.136(A). Matching the insulation rating of Conductors of Different Systems does not apply to Class 2 conductors per NEC 300.3(C)(1), Informational Note No.1.
B. Wall box dimmers will typically have two conduits: One conduit for line-voltage power, and one conduit or conduit stub for the 0-10V control wiring.
C. The 0-10V wiring may be routed in free air if:
   1. The room is approximately 900 sq.ft. or less and the 0-10V wiring stays within the room.
   2. The ceiling space is a non-plenum and all splices of 0-10V wiring are spliced in a box.
   3. Were permitted to be routed free air, the 0-10V wiring may be tie-wrapped to the outside of the luminaire fixture whip per NEC 300.11(B)(2). Tie-wraps shall be UL listed for UV resistance.
D. At each luminaire, separate openings (either manufactured knock-outs or punched openings) shall be used for the line-voltage power and the 0-10V wiring. The EC shall use an NM cable connector at the opening for the 0-10V wiring. Zero-to-10V conductors entering and within a luminaire enclosure shall maintain a minimum separation of 6 mm (0.25 in.) per NEC 725.136(D).

3.03 FIELD QUALITY CONTROL

A. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.04 LUMINAIRE CONNECTIONS

A. Recessed, including Master-Satellite connections:
   1. Use a luminaire fixture whip from a J-box for recessed lay-in luminaires. Luminaire fixture whips shall be aluminum or steel AC Cable (Armored Cable) or Flexible Metal Conduit (FMC).
   2. Cable/Conduit whips shall be 3/8" (10 mm) minimum diameter, six feet (1.8 m) maximum length.
   3. Flexible whips or pre-wired systems between master and satellite luminaires may be supported by the ceiling grid wires.
   4. The flexible connectors shall be steel, galvanized, clamp type with locknut, snap-in type with locknut, or snap-in connector type, including those used on the master-satellite units.
B. Chain or Cable Hung (unfinished spaces):
   1. Use manufacturer's SO cord or a luminaire fixture whip from a J-box. Luminaire fixture whips shall be aluminum or steel AC Cable (Armored Cable) or Flexible Metal Conduit (FMC).

2. Conduit whips shall be 3/8" (10 mm) minimum diameter. Conduit whip or SO cord shall be cut to length (six feet (1.8 m) maximum) and shall allow movement of the chain/cable/luminaire, but shall not be long enough to "loop" and shall present a neat and workmanlike appearance.
3. Luminaire field wired flexible cord installations shall be connected per NEC 410.62.
4. The flexible connectors shall be steel, galvanized, clamp type with locknut, snap-in type with locknut, or snap-in connector type, including those used on the master-satellite units.
5. Conduit whip slack shall be tie-wrapped to the chain supports. Tie-wraps shall be UL listed for UV resistance.

C. Cable Hung (finished spaces):
1. Use manufacturer's SO cord from luminaire to a J-box.
2. SO cord shall be cut to length (six feet (1.8 m) maximum) and shall allow movement of the cable/luminaire but shall not be long enough to "loop" and shall present a neat and workmanlike appearance.
3. SO cord slack may be tie-wrapped to the cable supports. Tie-wraps shall be UL listed for UV resistance.
4. Luminaire field wired flexible cord installations shall be connected per NEC 410.62.

D. Surface Mounted (unfinished spaces):
1. Provide direct conduit and box connection.

E. Surface Mounted (finished spaces):
1. Provide direct conduit and box connection. Use surface metal raceway where indicated on drawings. Conceal box and conduit where appropriate. Flexible metal conduit shall not be used where it is exposed.

3.05 ADJUSTING AND CLEANING

A. Align luminaires and clean lenses and diffusers at completion of Work. Clean paint splatters, dirt, and debris from installed luminaires.
B. Aim and adjust luminaires as indicated on Drawings or as directed by the A/E.
C. Touch up luminaire finish at completion of work.

3.06 INTERFACE WITH OTHER PRODUCTS

A. Provide controls as indicated on the plans. Refer to section 26 27 26 and 26 09 43. All controls shall be compatible with the luminaires/ballasts/drivers being installed.

3.07 FIELD QUALITY CONTROL

A. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

END OF SECTION

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SECTION 26 56 29
SITE LIGHTING

PART 1 – GENERAL

1.01 SCOPE OF WORK
A. The work under this section includes exterior luminaires and accessories, poles, and foundations.

1.02 SECTION INCLUDES
A. Luminaires
B. Poles
C. Pole Foundations

1.03 RELATED WORK
A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this section.

1.04 SUBMITTALS
A. Shop Drawings: Indicate dimensions and components for each luminaire, pole and base.
B. Product Data: Provide dimensions, ratings, performance and photometric data, manufacturer's standard warranty information, lamp and ballast data, weights and accessory information for each type.

1.05 OPERATION AND MAINTENANCE DATA
A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

1.06 PROJECT RECORD DOCUMENTS
A. Accurately record actual locations of each luminaire, pole and underground circuit.
B. Provide record drawings of the final, as installed and measured, point to point foot-candle layout for each area involved.

1.07 COORDINATION
A. Use bolt templates and pole mounting accessories to install anchor bolts in pole base.

PART 2 – PRODUCTS

2.01 LUMINAIRES
A. Furnish products as specified in schedule on Drawings.
B. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.
C. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.
D. Metal parts shall be free of burrs and sharp corners and edges.
E. Sheet metal components shall be corrosion-resistant aluminum, unless otherwise indicated. Form and support to prevent warping and sagging.
F. Housings shall be rigidly formed, weather- and light-tight enclosures that will not warp sag or deform in use. Provide filter/breather for enclosed luminaires.
G. Doors, Frames and Other Internal Access shall allow smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.
H. Plastic parts shall be high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

I. Light shields shall be metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.
J. Lenses and refractors gaskets shall use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

2.02 LED LUMINAIRES

A. LED Luminaires shall meet all DesignLights Consortium® (DesignLights.org) Product Qualification Criteria. This does not require that the luminaire be listed on the DesignLights Consortium's® Qualified Products List, but they must meet the Product Qualification Criteria. The technical requirements that the luminaire shall meet for each Application Category are:
   1. Minimum Light Output.
   2. Zonal Lumen Requirements.
   3. Minimum Luminaire Efficacy.
   4. Minimum CRI.
   5. L70 Lumen Maintenance.
   6. Minimum Luminaire Warranty of 5 years (not pro-rated) to include LED driver and all LED components.
B. The color temperature of exterior LED luminaires should not exceed 4100K (nominal).
C. Color Consistency: Exterior luminaires shall use a maximum 5-step MacAdam Ellipse binning process.
D. Glare Control: Exterior luminaires shall meet DesignLights Consortium's® criteria for Zonal Lumen Distribution requirements or Backlight-Uplight-Glare (BUG) standards for exterior luminaires.
E. Luminaire shall be mercury-free, lead-free, and RoHS compliant.
F. Luminaire shall comply with FCC 47 CFR part 15 non-consumer RFI/EMI standards.
G. Light output of the LED system shall be measured using the absolute photometry method following IES LM-79 and IES LM-80 requirements and guidelines.
H. Luminaire shall maintain 70% lumen output (L70) for a minimum of 50,000 hours.
I. Driver shall have a rated life of 50,000 hours, minimum.
J. Lumen output shall not depreciate more than 20% after 10,000 hours of use.
K. Driver and LEDs shall be furnished from a single manufacturer to ensure compatibility.
L. Where color rendering is extremely important, specify a CRI of 95 and an R9 value of 80+.
M. Luminaire Color Rendering Index (CRI) shall be a minimum of 70 for exterior luminaires.
N. LED luminaire shall be thermally designed as to not exceed the maximum junction temperature of the LED for the ambient temperature of the location the luminaire is to be installed. Rated case temperature shall be suitable for operation in the ambient temperatures typically found for the intended installation. Exterior luminaires to operate in ambient temperatures of -20°F to 122°F (-29°C to 50°C).
O. LED driver shall have a minimum power factor (pf) of 0.9 and a maximum crest factor (cf) of 1.5 at full input power and across specified voltage range.
P. Luminaire shall operate normally for input voltage fluctuations of plus or minus 10 percent.
Q. Luminaire shall have a maximum Total Harmonic Distortion (THD) of 20% at full input power and across specified voltage range.
R. Wiring connections to LED drivers shall utilize polarized quick-disconnects for field maintenance.
S. All connections to luminaires shall be reverse polarity protected and provide high voltage protection in the event connections are reversed or shorted during the installation process.
T. Fuse Protections: All luminaires shall have built-in fuse protection. All power supply outputs shall be either fuse protected or be Polymeric Positive Temperature Coefficient (PTC)-protected as per Class 2 UL listing.
U. All luminaires shall be provided with knockouts for conduit connections.
V. The LED luminaire shall carry a limited 5-year warranty minimum for LED light engine(s)/board array, and driver(s).
W. Provide all of the following data on submittals:
   1. Delivered lumens
   2. Input watts
   3. Efficacy
   4. Color rendering index.

2.03 POLES

A. Furnish products as specified in schedule on Drawings.
B. Handhole: With removable weatherproof cover.
C. Anchor Bolts: As recommended by pole manufacturer. Provide template, flat washers, lock washers, and hex nuts for each pole.

2.04 POLE FOUNDATIONS

A. Construct from reinforced concrete in sizes as shown on drawings.
B. The exposed surface area of the foundation shall have the forms removed and the concrete rubbed out to a smooth finish.
C. Provide foundations for poles, bollards, and ground-mounted flood and accent lighting. Construct from reinforced concrete in sizes as shown on drawings and to meet the minimum structural requirements of SPS 362.1807 Shallow Post Foundations, and IBC 1807.3 Embedded Posts and Poles.
D. Place the anchor bolts in pole bases so that the luminaire will be oriented perpendicular to the curb/street/sidewalk/parking lot or as indicated on the plan.
E. Provide a concrete-encased electrode (UFER) grounding system for grounding the foundation, luminaire, and pole:
   1. Provide twenty-five (25) feet of #6 bare stranded copper grounding electrode conductor.
   2. Extend three (3) feet of the grounding electrode conductor out the top of the foundation for connection to the luminaire/pole.
   3. Clamp the grounding electrode conductor to the top of the rebar cage. Use a clamp rated for such use such as an Erico EK16 or similar.
   4. Spiral a minimum of ten (10) feet of the grounding electrode conductor around the outside of the rebar cage.
   5. Loop the remaining conductor around the rebar cage at the bottom of the foundation in direct contact with earth.
F. The exposed surface area of the foundation shall have the forms removed and the concrete rubbed out to a smooth finish.

2.05 POLE BASE J-BOXES

A. For pole bases with multiple conduits to other poles/locations, the contractor may provide a non-metallic j-box with a curved cover mounted in the side of the exposed part of the base to accommodate the multiple conduits. Boxes shall be NEMA 3R Carlon Nonmetallic Curved Lid J-Boxes or equal. Mount j-box centered at 20” above grade. Use only in poles 18” in diameter and larger. Locate boxes 90-degrees or 180-degrees from traffic. Install boxes per manufacturer’s recommendations.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturers' instructions.
B. Minimum underground conduit size shall be 1 inch.
C. Underground and exterior wire shall be type XHHW-2 or USE.
D. Project anchor bolts 2 inches (50 mm) minimum above base.
E. Install all anchor bolts and handhole fasteners with anti-seize compound.
F. Install poles plumb. Provide shims or double nuts to adjust plumb.
G. Use belt slings or non-chafing ropes to raise and set pre-finished luminaire poles.
H. Bond each luminaire, each metal accessory, the ground rod and the pole to the branch circuit equipment ground conductor with a separate ground wire sized per NEC or as shown on the drawings.

3.02 FIELD QUALITY CONTROL

A. Operate each luminaire after installation and connection. Inspect for improper connections and operation.

3.03 ADJUSTING

A. Aim and adjust luminaires as indicated on Drawings or as directed by the A/E.

3.04 CLEANING

A. Clean photometric control surfaces.
B. Clean finishes and touch up damage.

END OF SECTION

SECTION 31 05 00
COMMON WORK RESULTS FOR EARTHWORK OUTSIDE BUILDING FOOTPRINT

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: Furnish all labor, equipment, and materials to complete all earthwork including:

1. Site clearing, grubbing, stripping, and earth moving.
2. Excavation, filling, backfilling, compaction, and grading.
3. Preparation of subgrade for slabs on grade, walks, pavements, roads, and parking areas.
4. Proof-rolling of Subgrade.
5. Furnish, apply, and rough grade topsoil.
6. Removal of structures at or below grade.
7. Provide and pay for all necessary permits.
8. Shoring, cribbing, and bracing to safely support excavations.
9. Contractor shall determine if the site "balances" and include in their bid any import or export of material including any spoils from utilities.

B. Work Not Included: Excavating and backfilling inside and outside of building as required for plumbing, heating, and electric work installed underground, including tanks, pits, manholes, catch basins and inlets, which are included in other Sections.

1.2 REFERENCE STANDARDS

A. ASTM A444 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process for Culverts and Underdrains

B. ASTM C136 - Sieve Analysis of Fine and Coarse Aggregates

C. ASTM C207 - Hydrated Lime for Masonry Purposes

D. ASTM D1556 - Standard Test Method for Density of Soil in Place by the Sand - Cone Method

E. ASTM D422 - Particle Size Analysis of Soils

F. ASTM D423 - Liquid Limit of Soils

G. ASTM D424 - Plastic Limit and Plasticity Index of Soils

H. ASTM D698 - Moisture-Density Relations of Soils and Soil-Aggregate. Mixtures using 5.5 lb. Rammer and 12-inch Drop (Standard Proctor Test)

I. ASTM D1452 - Soil Investigation and Sampling by Auger Borings

J. ASTM D1557 - Moisture Density Relations of Soils and Soil - Aggregate Mixtures using a 10 lb. Rammer and 18-inch Drop (Modified Proctor Test)

K. ASTM D2167 - Density of Soil in Place by the Rubber-Balloon Method

L. ASTM D2487 – Classification of Soils for Engineering Purposes

M. ASTM D2922 - Standard Test Methods for Density of Soil and Soil-Aggregates in Place by Nuclear Methods (Shallow Depth).

N. Standard Specification for Highway and Structure Construction, State of Wisconsin.

O. Specification 01 45 29 Laboratory Testing

1.3 QUALITY ASSURANCE

A. Perform earthwork in compliance with local, state, and OSHA requirements.

B. Project Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of the geotechnical engineer and represent interpretations of the subsoil conditions, tests, and results of analyses conducted by the geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from this data by Contractor.

1. Contractor shall make additional test borings and conduct other exploratory operations, as necessary.

2. The geotechnical report is included in the Existing Conditions section of the Project Manual.

C. Testing and Inspection Service: Owner shall engage soil testing and inspection service (Geotechnical Engineer) for quality control testing during earthwork operations.

1. Additional copies of testing reports shall be sent to the architect.

2. Testing agency representatives on the site are required to read and understand the requirements of the Construction Documents, the Soil Report, and this Section. Contractor shall verify this condition.

3. Proof rolling, undercutting, and fill operations shall be performed under the observation of the Geotechnical Engineer.

4. Approval by Geotechnical Engineer must be given prior to the placing of any concrete or fill material, and whenever the Soil Report or actual conditions encountered indicate loose or variable soil conditions, variable soil coloration, unexpected materials, etc. Do not proceed if unsuitable conditions are encountered. Notify Geotechnical Engineer immediately.

5. Testing agency shall provide to Owner, Architect, and Engineer written field reports that topsoil and unacceptable soils have been removed, reports of actual bearing pressures encountered, and all compaction tests. Provide written verification that existing soils and fill materials achieve specified bearing capacity at all locations including lawn and unpaved areas.

6. Provide Geotextile Fabric Information to Geotechnical Engineer for review.

D. Grading Limits: Confine work to the Construction Limits as indicated on the drawings. In the absence of such a designation on the drawings, confine work to the minimum area reasonably necessary to undertake the work as determined by the Engineer. All areas disturbed by excavation and grading, plus such additional areas as are disturbed by construction related activities including construction access and storage and installation of materials shall be considered the "Construction Area."

E. Wherever provisions of the Specification, Drawings, including supplements and addenda, or the requirements of Geotechnical Engineer conflict (e.g., compaction materials, required percent compaction, etc.), the more stringent requirements shall govern unless approved in writing by Engineer.

F. Conform to Federal, State, and local ordinances with respect to excavations, disposal of waste, burning, air quality, noise, erosion, water runoff, etc.

G. Record Drawings: Maintain record drawings of all underground utilities, drain tiles, or other structures encountered, and/or earthwork made as part of this project on original drawings prepared by the installing Contractor/Subcontractor.

H. Earth Retention System: Contractor is completely responsible for the design and construction of adequate and safe temporary shoring, bracing, retaining structures, and excavations. All systems shall be designed for potential sand seams and water, which may cause cave-ins, and/or require additional bracing, casing of bore holes, dewatering, etc.

1.4 SUBMITTALS

A. None

1.5 QUANTITIES

A. Elevations provided on the plans are finished elevations including topsoil. Finish topsoil depth shall be as specified in this section or as shown on the drawings, whichever is greater.

B. Contractor shall be solely responsible for determining all earthwork quantities based on the existing and proposed elevations provided on the plans. Any geotechnical investigations provided by the Owner apply only to those locations that the data was collected and may not be indicative of conditions elsewhere on the site. The Contractor is responsible for collecting any additional geotechnical or survey data he deems necessary to complete an accurate estimate of earthwork quantities.

C. Contractor shall be solely responsible for balancing site materials. If onsite excavation and borrow operations do not provide enough suitable material for fill areas, Contractor shall coordinate and pay for excavation, transport, and placement of imported material meeting the specifications of the contract documents. If excavation results in excess materials, Contractor shall coordinate and remove all excess materials from the site (at no cost to the owner). No excess material can remain onsite.

D. If contractor finds the geotechnical information or existing or proposed elevations shown on the plans to be erroneous, he shall notify the Project Manager immediately.

PART 2 - PRODUCTS

2.1 FILL MATERIALS

A. Structural Fill: Well graded, granular material, bankrun sand and gravel, or crushed or natural stone, free of shale, clay, friable materials, and debris; tested in accordance with ANSI/ASTM C136 within the following limits:

1. Maximum size of aggregate shall be 2" with not more than 80% passing on a 3/4-inch sieve, with not less than 50% by weight passing a No. 4 sieve.

2. Not more than 15% shall pass the No. 200 sieve.

3. When used for bedding under pipes, conduits or culverts, fill shall consist of material with greater than 50% by weight passing a No. 4 sieve and all particles passing a 1-inch sieve. Bedding material shall be selected and placed in accordance with the recommendations of the pipe manufacturers and in accordance with Chapter 6.43 of Standard Specifications for Sewer and Water Construction in Wisconsin, Latest Edition.

   a. Fill above utilities shall be clay where existing soils are clay.

   b. For all utilities and other excavations, provide anti-seep, concrete collars or cut-off walls, or other suitable means to cut off water where a water source could flow back to building.

4. Structural Fill shall achieve the required soil bearing pressure specified in the Contract Documents and Soil Report.

B. Fill placed in fabric or geogrid reinforced sub-grade areas in pavement areas shall be granular soil, such as 1-1/4 inch or 3/4-inch crushed stone aggregate, or other as recommended by the geotechnical engineer. Aggregate should not exceed the maximum recommended by the geotextile manufacturer.

C. Drainage Fill: Frost resistant, well graded, clean, angular/fractured, crushed stone or gravel (not sand), free of silt, clay, loam, friable or soluble materials, and organic matter; tested in accordance with ANSI/ASTM C136 within the following limits:

1. Not more than 5% shall pass the No. 200 sieve.

   a. Slab on grade subgrade: ASTM C33, Size 67.

   b. Building perimeter drain lines shall be surrounded with at least 12 inches of washed aggregate conforming to ASTM C33, Size 67.

   c. Perimeter drains at retaining walls shall be surrounded with at least 12 inches of washed aggregate conforming to ASTM C33, Size 67.

D. No. 2 Stone: Angular crushed limestone aggregate having uniform particle size of nominally 2 inches, essentially free of fines.

E. Lean Concrete: Minimum 1,500 psi compressive strength at 28 days.

F. Common Fill: Approved material from site, excavation or offsite, separated from materials which do not compact by tamping or rolling. Crushed stone, bank run gravel, or coarse

sand or general earth material free of particles larger than 6 inches, debris, peat, roots, cinders, wood, trash, organic material, or other objectionable material.

G. No organic, deleterious or frozen or "contaminated" material may be used for backfilling or fill material.

H. Geotextile Material: Conforming to WISDOT 645 and Soil Report with respect to Grab, Puncture and Burst Strength, Trapezoidal Tear, Permeability, and Apparent Opening Size.

1. Around stone surrounding draintile and trench drains: WISDOT 645.2.4 Type DF, Type A or better:

2. "Mirafi 140-N"

3. "ADS 5000"

4. "Amoco 4547"

5. "Contech C-45NW"

6. Approved equal

7. Under slab-on-grade when specified on plans as required: WISDOT 645.2.2 Type SAS:

8. "Mirafi 180-N"

9. "Mirafi FW404"

10. "ADS 8800"

11. "Amoco 4553"

12. "Contech C-80NW"

13. Terra Tex-N08"

14. Approved equal

15. Soil stabilization and subgrade reinforcement above poor soils: WISDOT 645.2.3 Type MS:

16. "Tensar BX-1200”

17. Approved equal

2.2 TOPSOIL

A. Topsoil to be furnished: If quantity of stored topsoil is inadequate or if none has been salvaged from site, this Contractor shall furnish sufficient topsoil to properly construct lawns. Topsoil furnished shall be a natural, fertile, friable soil, possessing characteristics of representative productive soils in the vicinity. It shall be obtained from naturally, well-drained areas. It shall not be excessively acid or alkaline or contain toxic substances which may be harmful to plant growth. Topsoil shall be without admixtures of stones,

stumps, roots, debris, or other objects 1" or more in diameter which might be a hindrance to planting operations. Topsoil shall be placed to a minimum depth of 6" after compaction.

B. Landscape Contractor shall provide, spread, and fine grade topsoil.

PART 3 - EXECUTION

3.1 GENERAL

A. Contractor to review specific method of soil preparation as listed in the geotechnical report.

B. Contractor to establish all heights and grades to properly execute work from benchmark established by a surveyor (from original survey work). It is strongly recommended that the original surveyor be contacted and used for all construction layouts as well as as-built surveys in an effort to avoid conflict between datums and horizontal control points used. Prior to construction layout, existing and proposed finished floor elevations shall be checked with respect to current site benchmarks to ensure elevations correspond with layout elevations.

C. Contractor shall provide all construction layout surveys to accurately locate the construction on the site.

D. Prior to start of work, Contractor shall be completely familiar with all conditions at the site, and shall account for conditions that may affect the work including: Geotechnical recommendations and methods, limitations on work access, space limitations, overhead obstructions, traffic patterns, local requirements, adjacent activities, etc. Failure to consider these requirements shall not be cause for claim of job extras.

E. Inspect areas and conditions prior to clearing, excavating, filling, and grading. Do not proceed until unsatisfactory conditions have been corrected.

F. Permits and Fees:

1. Apply for, pay for, and secure all permits required in connection with the work under this section from the governmental authorities having jurisdiction.

2. Pay all highway and dumping fees and repair damage to sidewalks, streets, or other public property, or to any public utilities.

3.2 PROTECTION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork and dewatering operations. Protect and maintain all lawns, beds, shrubs, trees, and other work that is to remain in place. See Specification 01 76 00 Protecting Installed Construction for additional information.

1. Should damage occur as a result of work performed under this Contract, restore to existing condition at no additional cost to Owner, in a manner acceptable to Architect.

2. Repair or replace trees and vegetation indicated to remain which are damaged by construction operations, in manner acceptable to Architect.

B. Conduct site clearing operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct roads or other occupied or used facilities without permission from Owner and authorities having jurisdiction.

C. Carefully remove items indicated to be salvaged, and store on Owner's premises where indicated or directed.

D. Provide and maintain temporary fences, planking, lights, warning signs, barricades, and guards necessary for protection of premises and public.

E. Maintain cut at satisfactory slope which will prevent collapse of embankments. Provide bracing and shoring as required to protect existing improvements, including outside contract limits, new construction, or excavations. Contractor is solely responsible for strength and adequacy of bracing or shoring and for safety. Conform to OSHA requirements. Restore any damaged improvements to their original condition.

F. Do not load vehicles hauling debris excessively as to cause spillage on to streets and roadways. Do not allow spilled materials to clog drainage of streets.

G. Keep sidewalks and streets adjoining the property broom clean and free of debris, excavated materials, rubbish, trash and obstructions, which might affect the safety of streets, walks, utilities, and property. Broom clean daily.

H. Use all means necessary to control dust on and near the work, if such dust is caused by the Contractor's operations during performance of the work, or if resulting from the condition in which the Contractor leaves the site.

I. Provide positive protection (mat/sheet coverings) for all excavation slopes to protect slopes from instability and deterioration due to rain, wind, or snow/ice.

J. Construct, maintain and protect erosion and sedimentation controls.

3.3 EXISTING UTILITIES

A. The Contract Drawings show such information as can reasonably be obtained regarding the location and nature of pipelines, storm sewers, water lines, natural gas lines, underground cables, etc. However, the accuracy or completeness of such information is not guaranteed. It shall be Contractor's responsibility to locate such underground features sufficiently in advance of operations to preclude damage to same.

B. Locate existing underground utilities in the areas of work. If utilities are to remain in place, provide adequate means of support and protection during earthwork operations.

C. Should uncharted or incorrectly charted, piping, or other utilities be encountered during excavation, consult Architect and appropriate utility company immediately for directions. Cooperate with Owner and utility companies for keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility company. The cost of repair of uncharted or incorrectly charted utilities will not be paid by the Owner.

D. Do not interrupt existing utilities serving facilities occupied and used by Owner or others except when permitted in writing by Architect and then only after acceptable temporary utility services have been provided. Provide minimum of 48-hour notice to Owner and receive written notice to proceed before interrupting any utility.

E. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies for shut-off of service if lines are active.

3.4 SITE CLEARING AND GRUBBING

A. Clear area within contract limits of trees, stumps, brush, shrubs, vegetation, rubbish, and other perishable or objectionable matter.

B. Remove all cleared material from site.

C. An effort has been made to show the majority of existing trees on-site on the plans, however, Contractor to visually verify removal limits prior to bidding.

D. Existing bituminous and concrete paving, roads, walks, and curbs shown in areas of proposed improvements or reused grades, shall be removed by this Contractor to a depth of at least 10” below the paved surface.

E. Completely remove stumps, roots, and other debris protruding through ground surface. Use only hand methods for grubbing inside drip line of trees indicated to remain.

F. Remove existing above-grade and below-grade improvements, unsuitable fill, cinders, concrete, old foundations, and any other unsuitable material as indicated on Drawings, soil report or interfering with new construction.

G. Burying or burning of materials on the site is not permitted.

H. Trim limbs and branches of trees to be left in place which overhang roadbeds or structure to provide proper clearance.

3.5 SITE GRADING

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Preparation of subgrades after stripping vegetation, organic or other unsuitable materials shall consist of:

1. Proof-rolling under the observation of an experienced Geotechnical Engineer or Technician to detect soft, wet, yielding soils or other unstable materials. Proof rolling shall consist of rolling the subgrade with a heavily loaded rubber-tired vehicle such as a loaded scraper or tandem axle dump truck.

    a. Undercut soft or unsuitable areas of subgrade 2 to 3 feet or as directed by Geotechnical Engineer. Backfill with granular soil (as indicated in the geotechnical report) fill in maximum 8-inch loose lifts, and compact to the minimum required degree of compaction as specified in Compaction Section.

    b. Remove the top 18" of the subgrade where expansive clays (Liquid Limit greater than 50) are encountered. Replace with granular structural fill.

    c. Remove, as directed by Geotechnical Engineer, underlying bearing soils that are disturbed by construction, weather, or earthwork activities, and replace with structural, engineered fill.

d. In pavement areas, backfill half of undercut with No. 2 stone placed in 8" lifts and compacted until no further vertical and lateral movement is observed. Backfill upper half of undercut with Base Coarse Aggregate placed in 8" lifts and compacted as specified in Compaction Section.

e. Provide Geotextile Fabric before backfilling if soft soils exist at bottom of excavation.

2. Scarify top 6 to 8 inches.

3. Moisture condition soils as required.

4. Recompaction to same minimum in-situ density required for similar materials.

5. Stone Base course shall be proof rolled prior to placing pavement section as well.

C. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

D. All subgrades shall consist of and be:

1. Underlain by suitable bearing material.

2. Free of all organic, frozen, or other deleterious material.

3. Observed, tested, and approved by Geotechnical Engineer.

3.6 CUT AND FILL

A. Provide all necessary cutting and filling required to change existing grade specified or as shown on drawings.

1. Note: A vibratory smooth drum roller should not be used on clay soils.

2. In areas under proposed pavement, consult with geotechnical engineer and report for construction methods.

3. Rough grade all seeded areas to 6" below finish grade elevation. Where topsoil of sufficient depth is encountered, grade shall be brought to final established grade. Minimum depth of topsoil shall be 6".

4. All roads, drives, and parking areas etc. shall be rough graded to 15" below finish grade, or as required to install subgrade and finish pavement.

B. Fill in excess of 12" shall be constructed in 8" layers and shall be rolled with rubber-tired equipment or sheepsfoot rollers, or compacted with vibratory equipment, whichever is best suited for soil being compacted. Fill under paved areas shall be compacted to 95 percent Modified Proctor, as per ASTM D 1557.

C. Where there is a great change in grade, a maximum slope of three to one (3:1) shall be maintained. Reference Section 31 25 00 - Erosion Control for Specific Requirements.

D. Do no grading until sewers, water mains and other utilities are installed. After backfill has settled and when directed, fill shallow places to bring to proper grade.

E. Excess excavated material from trenches and other excavations will be piled on site if to be reused or removed from site by respective Contractors. Deposition and spreading shall be done by this Contractor.

1. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

2. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.7 EXCAVATING

A. Excavate and remove whatever materials encountered, including existing pavements, abandoned building foundation walls, footings and slabs, and unsuitable fill as required to place within finish elevations shown, all footings, walls, trenches, pits, ground floor slabs, drain tiles inside and around basement to complete the project.

1. Remove rock to lines and grades indicated, to permit installation of permanent construction without exceeding the following dimensions: 12 inches outside of concrete forms at footings.

2. 6 inches outside of minimum required dimensions of concrete cast against grade.

3. 6 inches beneath bottom of concrete slabs on grade.

B. Maintain pit or pits to which all excavated parts shall be drained. Provide, operate, and maintain suction and discharge lines, pumps, and other equipment necessary to drain and keep all excavations, trenches, and entire subgrade area free of water under any and all circumstances which may arise. Notify Geotechnical Engineer if springs or water seepage are encountered during grading for possible construction procedure revisions or inclusion of subgrade drainage system.

C. Excavated earth shall remain on site, if possible, and placed where directed.

1. After final grading work is complete, remove any excess earth from premises. Where site constraints dictate, excavated earth shall be stored off-site or landfilled.

2. All surplus earth shall be removed from premises.

D. Additional Excavation: When excavation has reached required subgrade elevation, notify Architect and Geotechnical Engineer for inspection of conditions.

E. Unauthorized Excavation: Consists of removal of materials beyond indicated subgrade elevations, limits, or dimension without specific direction of Geotechnical Engineer. Unauthorized excavation, as well as remedial work directed by Architect and/or Geotechnical Engineer, shall be at Contractor's expense.

F. Frost Protection: All open footings, trenches and exposed floor slab areas must be protected against frost impregnation.

G. Stability of Excavations:

1. Slope sides or excavations to comply with governing codes and ordinances, including OSHA Subpart P of 29 CFR 1926, or successor regulations. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Unless required otherwise by code or unless authorized by Geotechnical Engineer, slopes for excavations 20 feet deep or less should not exceed 1:1 for soil Types A and B and 1-1/2 (horizontal):1 (vertical) for soil, Type C.

2. Maintain side and slopes of excavations in a safe condition until completion of backfilling.

H. Do not place excavated materials where they will inconvenience the public, impede travel, or impede surface drainage unless such drainage is being safely rerouted away from the excavation without causing other damage. Do not place excavated materials close to a trench or excavation, unless shoring of adequate strength is provided to support the additional loads that are imposed.

I. Tunnel under, or remove and replace, sidewalk and curb in areas of excavation to the nearest joint. Remove all pavements, including curbs and gutters, to neat and straight lines to the limits of removal by a two-step method. Limit the initial removal to the immediate area of the proposed work. Full depth saw cutting is not required for this phase of the removal. After the work is completed, and immediately prior to the pavement replacement, make a full depth sawcut to neat and straight lines outside the widest point of excavation. Make the lines of sawcut parallel to existing joints, or parallel or perpendicular to pavement edges so as to form a neat patch. Carefully remove all remaining pavement within the sawcut area to the lines of the sawcut. Do not disturb existing base materials between the area disturbed by the work and the sawcut line during the sawcutting, pavement removal, or pavement replacement processes.

J. If field tile is encountered during the excavation, the Contractor shall make provisions for continuing the drainage on an interim basis and immediately notify the Architect and Geotechnical Engineer. Field tiles shall be re-routed wherever possible.

3.8 GEOTEXTILE FABRIC

A. Install in accordance with WISDOT 645, Soil Report and Manufacturer's Specification and Requirements with a minimum overlap of two (2) feet.

1. Provide around drain tile, wherever shown on drawings and/or recommended/specified in the Soil Report.

2. Where piping vertically intersects the Geotextile Fabric, run fabric up pipe and tape prior to backfilling.

3. Where horizontal piping is installed after and below the Geotextile,

a. Cut the Geotextile in a line centered on the pipe excavation and fold back.

b. After pipe installation, backfill to the bottom of the Geotextile, fold the fabric back, and tape the joint.

c. Tape a 4-foot-wide strip of Geotextile, centered over the cut joint.

B. Geotechnical Engineer shall review and approve installation and provide written report to Architect/Engineer.

3.9 BACKFILL AND FILL

A. General: Place acceptable tested and approved soil material in layers to required subgrade elevations, for each area classification listed below.

1. Structural/Engineered Fill:

   a. Use as fill or backfill in excavations against walls (except as noted in Item 2), under walks, steps, and pavements and under interior building slabs, except as noted in Item 3 below.

   b. Use as bearing material below footings and above natural occurring bearing soil where unsuitable material has been removed.

   c. Amount or width of structural fill against walls shall be per this specification, as shown on drawings, or as directed by Geotechnical Engineer. The more stringent requirement shall be used.

2. Drainage Fill:

   a. Use as final 6" minimum layer (or greater as shown on Contract Documents or Soil Report) for granular sub-beds under all exterior floor slabs resting on earth and exterior sidewalks, and steps.

   b. Use around all drain tile, piping, etc. prior to backfilling with structural fill.

3. Exterior Pavement Subbeds: Use as final 6" minimum layer (or greater as specified on the plans, in Section 32 11 23.33 Dense Graded Base or Soil Report) for granular crushed stone sub-bed under exterior drives, parking areas and ramps. See Soil Report for pavement design requirements.

4. Common Fill: Use under unpaved exterior areas.

B. Prior to Backfill Placement: Backfill excavations as promptly as work permits but not until completion of the following:

1. Acceptance by Geotechnical Engineer of construction below finish grade.

2. Inspection, testing and approval of underground utilities and systems.

3. Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structures and remove in manner to prevent settlement of the structure or utilities or leave in place if required.

4. Surveying locations of underground utilities for Record Documents.

5. Removal of mud, water, caved-in, softened or disturbed soil, or frozen soil as directed by Geotechnical Engineer.

6. Removal of trash and debris.

7. When existing ground surface has a density less than that specified under "Compaction" for the particular area classification, break up the ground surface, pulverize, moisture-condition to the optimum moisture content, and compact to required percentage of maximum density.

C. Placement and Compaction:

1. Place backfill and fill materials in layers not more than 8" in loose depth for material compacted by heavy compaction equipment, and not more than 4" in loose depth for material compacted by hand-operated tampers. Equipment shall be compatible with type of soil to be compacted.

2. Place backfill and fill materials evenly adjacent to structures, to required elevations. Take care to prevent wedging action of backfill against structures by carrying the material uniformly around structure to approximately same elevation in each lift. Lifts should be placed horizontally and in uniform thicknesses.

3. Extend fill a lateral distance of at least 1 foot for each foot of new fill required, with a minimum of six feet (6') beyond the edge of buildings and foundations. Against walls, free-draining granular structural backfill should extend a lateral distance of at least 4 feet from the outside face of the wall.

4. Notify, coordinate, and cooperate with Testing Agency regarding placement of fill. Each layer must be approved before the next layer is started.

3.10 COMPACTION

A. General: Control soil compaction during construction, providing minimum percentage of density specified for each area classification.

B. It is the responsibility of the Contractor to provide all necessary compaction equipment and other grading equipment that may be required to obtain the specified compaction. Compaction of controlled backfill by travel of grading equipment will not be considered adequate for uniform compaction. Hand guided vibratory or tamping compactors will be required whenever controlled backfill may be placed adjacent to walls, footings, columns or in confined areas.

C. Percentage of Maximum Density Requirements:

1. Compact soil to not less than the following percentages of maximum dry density determined in accordance with ASTM D1557, Modified Proctor Test. For clay soils, use ASTM D698 Standard Proctor methods and add 3% to percentages specified below, not to exceed 100%.

2. Foundations Fill: For fills less than or equal to 8 feet thick, compact the top 12" of existing soils and each layer of backfill or fill material to 95% maximum dry density. For fills greater than 8 feet thick, compact to 100% maximum dry density.

3. Lawn or Unpaved Areas: Compact the top 6" of existing soils and each layer of backfill or fill material to 88% maximum dry density, except future expansion areas shall be 95% maximum dry density.

4. Sidewalks: Compact the top 6" of existing soils and each layer of backfill or fill material to 95% maximum dry density.

5. Pavements: Compact the top 12" of existing soils and each layer of backfill or fill material to 95% maximum dry density, or until additional passes over the crushed stone produce visually no additional compaction.

6. Utility trench backfill should be compacted to at least 90% of the Modified Proctor (ASTM D1557) maximum dry density from 1 foot above the top of the pipe or conduit up to final surface grade to minimize subsidence. Under structures and pavements, compaction should be at least 95%. Trench backfill should be placed in lifts of 12 inches or less. Placement shall conform to Standard Specifications for Sewer and Water Construction in Wisconsin.

D. Moisture Control:

1. Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material. Scarify or disk as required to distribute water uniformly through soil. Apply water in manner to prevent free water appearing on surface during or subsequent to compaction operations. The moisture content of the soil should be within -1.0% to +2.5% for cohesive soils, -3% to +3% for cohesionless soils, of the optimum moisture content as determined by ANSI/ASTM D1557.

2. Remove and replace or scarify by repeatedly plowing and discing during favorable weather conditions to air dry, soil material that is too wet to permit compaction to specified density.

3. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing, or pulverizing until moisture content is reduced to a satisfactory value.

4. Clay soil bearing capacity and compaction levels are highly affected by water and construction activities.

a. Clay soils may require continued moisture control, modification with Portland Cement or hydrated lime, and/or per Maintenance Section of this specification until drainage subgrade and slab on grade are installed.

3.11 FINAL GRADING

A. General: Uniformly grade area within limits of grading under this section, including adjacent transition areas. Smooth finished surface, compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades. If fill is to be placed and compacted at the edge of a slope steeper than 4H:1V, overfill a minimum of 2 feet laterally beyond the final grade and trim back to design slope after achieving required degree of compaction.

B. Grading Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent ponding. Finish surfaces free from irregular surface changes.

1. All contours and/or spot elevations shown on Drawings are to finish grade, unless otherwise noted (i.e., top of pavement, topsoil, etc.). Contractor shall be responsible for making excavations or embankments to the subgrade elevations necessary such that the addition of the pavement, topsoil, or whatever surface improvement, will ensure that finished grades are met.

2. Contours indicated on drawings are the finished grade elevations. Review all grade elevations before commencing work to ensure that proper slopes for drainage, slopes for drives, walks, paving, etc., are maintained. If Contractor believes a deficiency is apparent, he shall notify the Architect for clarification and correction.

3. Pavements:

   a. Shape the surface of the areas under pavement to line, grade, and cross-section, compacted as specified, and graded to prevent ponding of water after rains. Rough grade tolerance shall conform to +0 in./-1 1/2 in. Fine grading tolerance shall conform to +0 in./-3/4 in.

   b. Include such operations as plowing, discing, and any moisture or aerating required to provide the optimum moisture content for compaction.

   c. Fill low areas resulting from removal of unsatisfactory soil material, obstructions, and other deleterious materials, using structural fill material. Shape to line, grade, and cross section as shown.

4. Ditches: Finish ditches to ensure proper flow and drainage. Conduct final rolling operations to produce a hard, uniform, and smooth cross-section.

C. Grading Surface of Fill Under Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of +0 in./-3/4 in.

D. Compaction: After grading, compact subgrade surfaces to the percentage of maximum density for each area classification.

E. Preparation for Lawn Construction: Preparation of Subgrade: Grade and uniformly compact subgrade so that it will be parallel to proposed finished grade. Loosen subgrade materials and mix to a depth of 8". Remove all stones over 1" in size and remove all sticks and rubbish. Do not move heavy objects, except lawn rollers, over lawn areas after the subgrade soil has been prepared unless subgrade soil is again graded and loosened, as specified above, before topsoil is spread.

3.12 GRAVEL SUB-BEDS

A. Grade Control: During construction, maintain lines and grades including crown and cross-slope of subbase course. Grade and compact earth to required level to receive full depth of pavement including sub-beds.

B. Shoulders: Place shoulders along edges of subbase course to prevent lateral movement. Construct shoulders of acceptable soil materials, placed in such quantity to compact to thickness of each subbase course layer. Compact and roll at least 12 in. (0.3 m) width of shoulder simultaneously with compacting and rolling of each layer of subbase course.

C. Placing:

1. Stone base course shall only be installed after successful proof-roll (immediately preceding), observed by geotechnical engineer.

2. Place subbase course material on prepared subgrade in layers of uniform thickness not to exceed 8", conforming to indicated cross-section and thickness.

3. Maintain optimum moisture content (within -1% to +3%) for compacting subbase material during placement operations.

4. Wet down gravel sub-beds before pouring concrete (if applicable).

5. Placing tolerance: +0 in./-3/4 in.

D. If tests indicate work does not meet specified requirements, recompact or remove work, replace, and retest at no cost to Owner.

3.13 MAINTENANCE

A. Protection of Graded Areas:

1. Protect newly graded areas from traffic and erosion. Keep free of trash and debris.

2. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.

B. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, re-shape and compact to required density prior to further construction.

C. Settling: Where settling is measurable or observable at excavated areas during general project warranty period, remove surface (pavement, lawn, or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work and eliminate evidence of restoration to greatest extent possible.

3.14 DISPOSAL OF EXCESS AND WASTE MATERIALS

A. Removal from Owner's Property: Remove excess and waste materials, including excavated material, excess topsoil, trash, and debris, and dispose of it off Owner's property.

3.15 UNANTICIPATED SUBSURFACE CONDITIONS

A. If Contractor encounters conditions that are different during earthwork, paving and foundation construction operations than those anticipated, this fact shall immediately (within 24 hours) be brought to Owner's attention. If Owner's representative on the construction site observes subsurface conditions which are different than those anticipated by the Soil Report, this fact shall immediately (within 24 hours) be brought to Contractor's attention. Once unanticipated conditions have been identified, and Consultant has concurred, immediate negotiations will be undertaken between Owner and Contractor to arrive at a change in contract price for additional work or reduction in work because of the unanticipated conditions. Contractor agrees that unit prices as stated in the Bid Form shall apply for additional or reduced work under the Contract.

END OF SECTION

SECTION 31 22 16.15
ROADWAY SUBGRADE PREPARATION

PART 1 - GENERAL

1.01 SCOPE

A. The work under this section shall consist of providing all work, materials, labor, equipment, and supervision necessary to complete pavement subgrade preparation and provide a surface ready for constructing and supporting the Dense Graded Base, as required in these specifications, on the drawings and as otherwise deemed necessary to complete the work.

1.02 RELATED WORK

A. Applicable provisions of Division 1 govern work under this Section.

B. Related work specified elsewhere:

1. Section 30 05 00 – Common Work Results For All Exterior Improvements
2. Section 31 25 00 – Erosion Control
3. Section 32 11 23.33 – Dense Graded Base
4. Section 01 45 29 - Laboratory Testing

1.03 REFERENCE STANDARDS

A. Where these specifications do not cover portions of the work to be undertaken, the SSHSC in Wisconsin, current edition, shall govern the work.

1.04 QUALITY ASSURANCE

A. The Contractor shall conduct sampling, testing, and analysis as required by this section and elsewhere in the Contract Documents either by retaining the services of an independent construction materials testing consultant or with internal certified testers. The materials testing consultant shall meet the requirements of ASTM E329.

B. The A/E and Contractor's construction materials testing personnel shall observe all proof-rolling operations. The Owner's Project Representative shall also be informed of all proof-rolling operations. Provide minimum of 48 hours notice for all parties.

1.05 PERMITS/FEES

A. Contractor shall be solely responsible for obtaining all permits necessary to complete the work. Contractor shall pay all fees associated with obtaining permits. These include but are not limited to permits for work within public right-of-way, land disturbance permits and building permits.

PART 2 - MATERIALS

2.01 BREAKER RUN AGGREGATE

A. Crushed stone, rock or gravel meeting the requirements of either Breaker Run or Select Crushed material as defined in WisDOT Section 311.2 or WisDOT Section 312.2, respectively.

2.02 RECYCLED AGGREGATE AND PAVEMENT

A. Recycled or salvaged aggregate and pavement products shall be free of organics, clay, rocks greater than 3-inches in least dimension and all other deleterious materials. The successful Bidder may submit specifications for these materials for consideration by the A/E for use on the project as part of the submittal process following contract award.

2.03 GEOTEXTILE FABRIC

A. Fabric shall be insect, rodent, mildew, and rot resistant woven or nonwoven polyester, polypropylene, stabilized nylon, polyethylene, or polyvinylidene chloride. All fabric shall have the minimum strength values in the weakest primary direction. Fabric shall conform to WisDOT Section 645.2.8.

PART 3 - EXECUTION

3.01 PREPARATION

A. Review drawings and prepare work plan and schedule. Coordinate any necessary interruptions in site access with Owner's Project Representative, in accordance with other specification sections.

B. Remove topsoil from work area. Sawcut and remove pavement from work area as indicated on the drawings. Saw cuts shall be made for the full depth of pavement.

C. Grade roadways and parking areas to drain water away from buildings.

3.02 EXCAVATION

A. Excavate to elevations and dimensions as shown on the drawings and as necessary to complete construction. Excavations shall be sufficiently deep to provide for depth of base course and pavement.

B. Stones over 6-inches in size shall be removed from the loosened portion of the subgrade.

C. Notify OWNER'S Project Representative if correction of unauthorized excavation or over-excavation is necessary. Said excavations will be corrected by placement of Breaker Run Aggregate. Contractor will be responsible for all costs associated with correcting these excavations.

D. Segregate the various materials excavated. Excavated material that does not meet the requirements of backfill and excess excavated material, shall be removed from the site and disposed by the Contractor, unless directed otherwise by other specification sections or the Owner's Project Representative.

E. Locate spoil piles so they do not interfere with public travel, adjacent landowners, or other construction activities.

3.03 PREPARING THE FOUNDATION

A. The subgrade shall be constructed to have a uniform stability throughout. Use of recycled and salvaged aggregate and pavements shall be fully incorporated into subgrade soil. Construct the foundation to the required elevation with equipment and methods adapted for the purpose. Shape and compact to provide a smooth foundation, at required density, and at the proper elevation to receive the Dense Grade Base (See Section 32 11 23.33).

B. Compact material to minimize settlement and avoid damage to structures, pipes, utility lines and other features. Hand-place and compact material, as necessary.

C. It is the responsibility of the Contractor to provide all necessary compaction equipment and other grading equipment that may be required to obtain a subgrade that satisfies the conditions of a satisfactory subgrade as defined below. Vibratory plate or tamping type walk behind compactors will be required whenever backfill is placed adjacent to structures, pipes, utility lines and other features.

D. The prepared foundation shall be tested for compaction as defined in the paragraph entitled ‘Subgrade Approval / Proof Rolling’.

3.04 SUBGRADE APPROVAL / PROOF ROLLING

A. Prior to undercutting or excavating below subgrade (EBS) or placing any Dense Grade Base (See Section 32 11 23.33), contact the Owner’s Project Representative to schedule inspection of the subgrade and proof rolling of the subgrade. All proof rolling shall be completed in accordance with the requirements of the paragraph entitled ‘Quality Assurance’ and shall meet the criteria as defined below.

B. To complete proof rolling, entire pavement subgrade shall be provided with a relatively smooth surface, suitable for observing soil reaction during proof rolling.

C. Contractor shall schedule and provide a fully loaded tri-axle dump truck for proof – rolling. Loaded truck shall have a minimum gross operating weight of 30 tons. Test shall be conducted with “tag” or “pusher” axles retracted from the ground.

D. Proof rolling shall be accomplished in a series of traverses parallel to the centerline of the driveway, street, or parking area. The truck shall traverse the length of the street or parking area once for each 12’ of width at speeds less than 5 mph. Additional passes along the traverse shall be completed as directed by the Owner’s Project Representative to further define unsatisfactory subgrade.

E. Soft areas, yielding areas, cracked areas or areas where rolling or wave action is observed shall be considered indicative of an unsatisfactory subgrade. Such areas shall be undercut as outlined in subsequent subsections of this specification.

F. Once the subgrade has been proof-rolled and approved, protect the soils from becoming saturated, frozen, or adversely altered.

3.05 UNDERCUTTING/EXCAVATION BELOW SUBGRADE (EBS)

A. Undercutting/EBS shall be completed only when directed by the OWNER’S Project Representative or if unsatisfactory subgrade, as defined above, is observed. The Contractor shall not be compensated for any unauthorized undercutting/EBS. Measure

and document undercut areas and depths in consultation with OWNER'S Project Representative.

B. Excavate undercut areas to the depth specified by A/E or Owner's Project Representative using equipment with smooth cutting edge. Excavated undercut material that does not meet the specifications for fill needed elsewhere on site shall be removed from the site and legally disposed.

C. Undercut areas shall be backfilled with Breaker Run (or with a combination of Breaker Run and Geotextile Fabric) in maximum of 9-inch-thick lifts (compacted). Breaker Run shall be compacted to 90% Modified Proctor dry density.

D. Following installation and compaction of place Breaker Run material, the area shall be subject to the work defined in the paragraph entitled 'Subgrade Approval / Proof – Rolling'.

E. Undercutting/Excavation Below Subgrade (EBS) work shall include all materials, labor, equipment, and supervision necessary to remove the soils from the Project Site considered to be poor from the proof roll and backfill and compact with Breaker Run material brought to the Project Site. The cost of the compacted Breaker Run material is incidental to the unit price item for Undercutting/Excavation Below Subgrade (EBS). If Geotextile Fabric is required and is used in combination with the Breaker Run, the unit price for the Geotextile Fabric shall include all materials, labor, and equipment for installation.

3.06 RESTORATION

A. Roll all pavement subgrade surfaces using a smooth drum roller to promote an impervious surface and minimize percolation of water into the subgrade.

END OF SECTION

SECTION 31 23 00
EXCAVATION AND FILL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Drawings and general provisions of contract, including general and supplementary conditions and Division 1 Specification Sections, apply to this section.

B. This section includes excavation and earthwork for all site work including pavement earth subgrade.

1.02 DESCRIPTION OF WORK

A. Work includes stockpiling topsoil, excavating, loading, hauling, depositing, compacting, grading, pavement subgrade preparation, topsoil respreading, finish grading, and restoring surfaces as necessary to conform to lines, grades, and slopes as shown on plans.

B. Related work covered by other sections:

1. Section 31 23 43: Excavation and Fill for Pipes and Structures
2. Section 31 10 00: Site Clearing
3. Section 32 13 13: Concrete Paving

1.03 DEFINITIONS

A. Reference to percent maximum density shall mean a soil density not less than the stated percentage of maximum density for soil as determined by ASTM D698, "Moisture Density Relations of Soils", using 5.5-lb. rammer and 12-inch drop. (Standard Proctor Method).

1.04 TESTING

A. Contractor shall employ and pay for services of an independent testing laboratory for tests required to show compliance with specifications.

B. Contractor to provide equipment and materials as required for de-watering site areas for excavation operations.

C. Contractor to plan work and provide temporary means for routing storm water drainage as necessary during construction.

PART 2 PRODUCTS

2.01 MATERIALS

A. Earth: All materials not classified as rock or rubble including loam, silt, gumbo, peat, clay, soft shale, sand, gravel, and fragmentary rock or boulders which can be handled by normal earth moving equipment.

B. Rock: Boulders so large that they cannot be handled by normal earth moving equipment or solid deposits so firmly cemented together that they cannot be removed without continuous use of pneumatic tools or blasting.

C. Rubble: Buried concrete foundations, beams, walls, and other materials which cannot be removed without continuous use of pneumatic tools or blasting.

D. Topsoil: Organic well-draining soil free from clay lumps, rocks, stones, concrete, toxic minerals, roots over 1/4" in diameter or other material which will not provide good turf growth. Secure from stripping operations as required or provide as necessary for finish grading.

E. Contractor shall notify the Owner if unsuitable soils are encountered during construction. Acceptable materials for construction shall include:

1. Fill used for site construction shall be free of organic matter and debris. The soils shall have a liquid limit less than 45 and a plasticity index less than 20 to 25.
2. All backfill and subgrade for pavements shall be compacted to 95% of standard proctor and shall be within a range of 0% to 4% of the material's optimum moisture content.

PART 3 EXECUTION

3.01 EROSION PROTECTION

A. Code Compliance: The Contractor shall comply with soil erosion control requirements of the issued erosion control plan, permit, the construction drawings, and local ordinances. The Contractor shall take all necessary measurements to protect against erosion and dust pollution on this project site and all off-site borrow or deposit areas, during performance or as a result of performance.

B. Damage claims: The Contractor will hold the Owner harmless from any and all claims of any type whatsoever resulting from damages to adjoining public or private property, including reasonable attorney's fees incurred to Owner. Further, if the Contractor fails to take necessary steps to promptly remove earth sedimentation or debris which comes onto adjoining public or private property, the Owner may, but need not, remove such items and deduct the cost thereof from amounts due the Contractor.

C. The Contractor shall be responsible for compliance and fulfillment of all requirements of the issued erosion control permit.

D. Protection of existing utilities: The contractor shall protect existing gas, electric, water, fiber optic, subdrain lines, storm and sanitary service lines encountered during construction. Any damage shall be repaired by the Contractor to the Owners specifications at the Contractor's expense.

3.02 EXCAVATION

A. Excavate, load, transport, and place excavated materials as necessary to conform to lines, grades and slopes as shown on plans.

B. Roll and compact cut areas to density not less than specified for fill area.

C. If soft or yielding materials are encountered near finished grade in cut areas, remove unstable materials at a depth specified by Owner and replace with suitable materials and compact.

D. Excavate in manner to avoid construction of lenses, pockets, streaks, or layers of material differing from surrounding materials in fill areas.

E. Cooperate with Owner in selection of locations for placement of excavated materials which differ appreciably from surrounding materials.

F. Maintain excavation in free draining condition; provide drainage for any water or springs which may be encountered.

G. The Contractor shall notify the Owner should existing drain tile be encountered during excavation and earthwork activities. Contractor is to connect all existing tiles encountered during construction to the storm sewer system.

H. Provide temporary drainage facilities to prevent damage when necessary, to interrupt natural drainage or flow of storm sewers, culverts or subdrains.

I. Maximum height of vertical cut shall be three (3) feet.

3.03 FILL

A. Prepare areas for fill by discing, plowing, and scarifying to depth of 4 to 6 inches following topsoil removal under building pad or proposed paved areas.

B. If soft or yielding materials at existing grade are encountered, remove unstable materials, and replace with suitable materials and compact prior to fill operations.

C. When fill meets natural grade of slope, cut bench in existing slope to connect existing grade with new fill.

D. Step or bench all existing slopes greater than 5 horizontal to 1 vertical to connect existing grade with new fill.

E. Place no roots, brush, grass, or other organic material in fill under buildings, pavement, and pond areas. Place no material on fill when material or foundation is frozen.

F. Select material for each portion of fill with approval of the Engineer; select materials to avoid sharp change in texture.

G. Use fill material free of lenses, pockets, streaks, or layers of materials differing from surrounding materials.

H. Construct fill in horizontal layers not more than 9 inches in loose thickness.

I. Deposit each layer over full width of fill as separate and distinct operation.

J. After layer is deposited, smooth to uniform depth by means of suitable motor patrol or bulldozer.

K. Maintain fill in free draining condition, provide drainage for any water or springs which may be encountered, except in the pond areas.

L. If soft or yielding materials are encountered within fill areas due to trapped water, remove unstable materials and replace with suitable materials and compact.

3.04 COMPACTION

A. Contractor is responsible for all required compaction tests. Contractor will engage a qualified independent geotechnical engineering testing agency to perform field quality control testing.

   1. Allow testing agency to inspect and test subgrades and fill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

   2. Perform soil density and moisture tests on earthwork at locations selected by Owner to show compliance of compaction with specifications. Provide one test every 1,000 square yards of subgrade preparation, 1,800 square yards of fill placement, or as may be required by geotechnical engineer. Intent is to provide sufficient test to adequately control and represent the compaction procedures.

   3. If compaction fails density and moisture tests, rework fill by mechanical means until specified density and moisture is obtained; Contractor shall pay all costs for testing and retesting.

B. Compact all materials placed in fill.

C. Compact selected materials in horizontal layers with tamping or sheepsfoot roller; use roller designed to provide at least 200 psi distributed on one row of knobs; tamping feet must project not less than 6½ inches from face of drum.

D. Compact layer by rolling with tamping type roller until full weight of roller is supported by tamping feet.

E. Roller will be considered to be supported entirely on its tamping feet when feet do not penetrate more than 3 inches into material being compacted.

F. If soil is wet so that it will not sufficiently compact by one passage of roller per inch of loose thickness, provide one discing per 2 inches of loose thickness.
   1. Cut and stir full depth of layer.
   2. Allow interval of no longer than 2 hours between successive discings, or as directed by Geotechnical Engineer.
   3. After discing is completed, compact layer by specified rolling.

G. If soil is dry so that it will not satisfactorily compact by rolling, moisten material before compaction; manipulate material to secure proper distribution of moisture before compaction.

H. Compact fill slopes progressively until slopes are stable.

I. Place fill and compact on all sides of structures to same level as fill operation progresses to protect structures against displacement or other damage.

J. Areas adjacent to structures which cannot be tamped with rollers: hand tamp with mechanical tamper to same degree of compaction as specified for other parts of fill.

K. Place fill material in maximum of 8-inch lifts.

L. Whenever operations are suspended during period, when rain is likely to occur, smooth and compact surface to shed water readily.

M. Compact all fill material in non-paved areas to not less than 85% maximum density as determined by ASTM D698 (Standard Proctor Method) with moisture content within 0% to plus 4% points optimum moisture.

N. Compact all fill material in the upper 12 inches below paved areas, proposed building area, proposed future building area, and below footing elevations to not less than 95% maximum density as determined by ASTM D 698 (Standard Proctor Method) with moisture content within 0% to plus 4% points of optimum.

3.05 SUBGRADE PREPARATION

A. Shape and consolidate subgrade for placement of pavements.

B. Prepare subgrade as separate and distinct construction operation just prior to pavement placement.

C. Provide a uniform composition below top of subgrade of at least 12-inch depth under new paving plus 2 feet outside pavement limits.

D. Compact upper 12 inches with moisture and density control (95% MD). Moisture content to be 0% to 4% points of optimum.

E. Excavate top 6 inches of subgrade, scarify, pulverize, mix and recompact with moisture and density control. Pulverize, mix, and replace top 6 inches of subgrade and compact with moisture and density control (95% MD).

F. Other methods for construction of subgrade preparation may be considered for use if uniform composition of finished subgrade is obtained and moisture and density tests taken at top of final subgrade and at 6 inches below top of final subgrade meet specified requirements as approved by Owner.

G. Remove stones over 3 inches in size from subgrade and stockpile as directed by Owner.

H. If ruts or other objectionable irregularities form in subgrade during construction, reshape and reroll subgrade before placing pavement, fill ruts or other depressions with material similar to other subgrade material and compact. No extra payment will be made for subsequent subgrade re-compaction.

I. Construct to elevation and cross section such that, after rolling, surface will be above required subgrade elevation.

J. Proof roll subgrade with loaded tandem axle truck to determine uniformity and stability of subgrade.

K. If soft or yielding areas are located, remove unstable materials, and replace with suitable materials and compact as specified.

L. Complete final subgrade within drive areas by excavation to grade by use of steel-shod template supported on side forms or support rollers or by use of automatically controlled subgrade excavating machine.

M. Check subgrade elevation and grade within drives and parking areas by method approved by Owner prior to paving. No additional payment will be made for rework of subgrade after rain or snow events. The Contractor is responsible for scheduling subgrade operations with pavement installations to ensure proper timing of construction.

N. Maintain subgrade prior to and during paving operations; repair any damaged or disturbed areas prior to paving. No additional payment will be allowed for the re-compaction of subgrade area if work is not protected.

3.06 FINISH GRADING

A. Finish excavating and fill areas to conform to lines, grades and slopes as shown on plans or as directed by Owner.

B. Maximum allowable variation in finished earth grade from design grade outside of paved areas is 0.2 feet. Grade and slope all earth surfaces to drain.

C. Smooth and finish all earth surfaces disturbed by construction operations.

D. Provide continuous use of blade grader, dozer or similar equipment of adequate size and power to handle materials encountered during finishing of excavation and fill.

E. Respread stockpiled topsoil as required for finish grading to a minimum 6-inch depth.

F. Disc earth surfaces to depth of 3 inches and place topsoil 6 inches deep on finished earth surfaces; smooth and grade ready for turf bed preparation.

G. Schedule and coordinate topsoil respreading with seeding, sodding, and planting operations.

END OF SECTION

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SECTION 31 23 16
TRENCH AND BACKFILL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Trench excavation for pipe systems, manholes, intakes, and other structures.

B. Trench bedding and foundation stabilization.

C. Pipe and structure placement and backfill.

1.02 DESCRIPTION OF WORK

A. Perform all excavations required to complete the work shown on the plans.

B. Prepare trench excavations and shoring for new work, and install the utility lines, structures, and system components, including bedding and foundation stabilization.

C. Complete specified backfill operation.

1.03 SUBMITTALS

A. Submit under provisions of Division 1.

B. Samples, granular bedding material: submit 10-pound samples of each type, if required.

C. Samples, granular backfill material: submit 10-pound samples, if required.

D. Gradation reports for fill materials and bedding materials.

E. Results of Proctor and In-Place Density Tests on backfill.

F. Contractor will provide Material Certifications to the Engineer.

G. Contractor's dewatering plan.

1.04 SUBSTITUTIONS

A. Use only materials conforming to these specifications unless permitted otherwise by Engineer.

B. Obtain approval of Engineer for all substitutions prior to use.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver only materials that fully conform to these specifications or for which submittals have been provided to Engineer and approved for use.

B. Store delivered materials and excavated materials in locations that will not interfere with operations and minimize environmental damage.

C. Grade and shape stockpiles for drainage and protect adjacent areas from runoff. Provide erosion control around stockpiles.

D. Remove unsuitable and excess materials from the site.

1.06 SCHEDULING AND CONFLICTS

A. Construction Sequence:
   1. Attend a preconstruction meeting if required by Engineer.
   2. Submit plan for construction sequence and schedule prior to commencing construction.

B. Conflict Avoidance:
   1. Expose possible conflicts in advance of construction, such as utility lines and drainage

structures. Verify elevations and locations of each and verify clearance for proposed construction.
2. Complete other elements of the work that can affect line and grade in advance of other open cut construction unless noted on the plans.
3. Notify Engineer of conflicts discovered or changes needed to accommodate unknown or changed conditions.

1.07 SPECIAL REQUIREMENTS

A. Stop Work: Stop work and notify Owner immediately if contaminated soils, historical artifacts, or other environmental or historic items are encountered.

B. Use of Explosives: Not allowed.

C. Conform to local, state, and federal requirements.

D. Abandoned Utilities: Remove and dispose of abandoned utility lines including gas mains, water mains, sewer mains, telephone conduits, service lines, etc. required to complete the work. Said work shall be incidental to the project unless otherwise specified.

PART 2 PRODUCTS

2.01 EXCAVATED MATERIALS

A. Unclassified Excavation: Excavation of all materials encountered, except rock and over-excavation.

B. Rock Excavation: Boulders or sedimentary deposits that cannot be removed without continuous use of pneumatic tools or blasting.

C. Over-excavation: Excavation of soil or rock in trenches below the pipe zone.

D. Suitable Excavated Materials for Backfill:
1. Soil, clay, silt, sand, and gravel with moisture content suitable to achieve required compaction. ASTM D 2321, Class II through IVA (see 312316, 2.01, E).
2. Fine-grained soils according to ASTM D 2321 Class IVB (inorganic) (see 312316, 2.01, E) may be used in the final backfill upon approval of the Engineer.
3. Adjust moisture content of excessively wet, but otherwise acceptable, material by spreading, turning, aerating, and otherwise working material as necessary to achieve required moisture range.
4. Adjust moisture content of excessively dry, but otherwise acceptable material by adding water, then turning, mixing, and otherwise blending the water uniformly throughout the material until the required moisture range is achieved.
5. Lime or fly ash may be added to soils to produce a suitable backfill material. Uniformly mix soil and additive. Determine Standard Proctor maximum density and optimum moisture content of the modified material. Amount of additive applied is subject to Engineer's approval.

E. Non-Manufactured (Excavated) Backfill Materials: See Sections 2.03 and 2.04. Also applies for manufactured backfill.

F. Unsuitable Material: Remove unsuitable materials from the site, including, but not limited to, the following:
1. Rock with gradation not meeting the stated gradation for stabilization material.
2. Individual stones or concrete chunks larger than 6 inches, and averaging more than one

per each cubic foot of soil.
3. Frozen materials.
4. Stumps, logs, branches, and brush.
5. Trash, metal, or construction waste.
6. Soil in clumps or clods larger than 6 inches, and without sufficient fine materials to fill voids during placement.
7. Unsuitable soils, as defined in Section 311000, 2.03, excluding material used as topsoil.
8. Class V Material (ASTM D 2321).
9. Environmentally-contaminated soils.
10. Soils deemed unsuitable by the geotechnical engineer.

G. Replacement of Unsuitable Soils:
1. If the excavated material is determined by the Engineer to be unsuitable and cannot be conditioned so that it becomes suitable, furnish all necessary backfill material.
2. Remove and dispose of unsuitable material from the site.

2.02 STABILIZATION (FOUNDATION) MATERIALS

A. Clean 2-1/2 inch crushed stone or crushed portland cement concrete (PCC) material, with the following gradation:

Sieve	Percent Passing
2-1/2”	100
2”	90 to 100
1-1/2”	35 to 70
1”	0 to 20
1/2”	0 to 5

B. Engineer may authorize a change in gradation subject to materials available locally at time of construction. Subject to the Engineer’s approval, crushed concrete may be used if it is within plus or minus 5% of the gradation for each size of material.

2.03 CLASS I GRANULAR BEDDING AND BACKFILL MATERIAL (Storm Sewers and Sanitary Sewers)

A. Use gravel or crushed stone for granular bedding, complying with the following gradation:

Sieve	Percent Passing
1-1/2”	100
1”	95 to 100
1/2"	25 to 60
No. 4	0 to 10
No. 8	0 to 5

Note: Engineer may authorize the use of crushed PCC, for pipe sizes up to 12 inches, or a change in gradation subject to materials available locally at time of construction.

B. Use aggregates having a percentage of wear, Grading A or B, not exceeding 50%, determined according to AASHTO T 96.

2.04 CLASS II BACKFILL MATERIAL (Storm Sewers, Sanitary Sewers, and Water Mains)

A. Class II material is manufactured and non-manufactured open graded (clean) or dense graded (clean) processed aggregate, clean sand, or coarse-grained natural soils (clean) with little or no fines.

B. Class II material is non-plastic soil less than 1-1/2 inches in size and consists of the following:

SOIL TYPE	DESCRIPTION OF MATERIAL CLASSIFICATION	REMARKS SECTION
GW	Well-graded gravels and gravel-sand mixtures, little or no fines. 50% or more retained on No. 4 sieve. More than 95% retained on No. 200 sieve. Clean.	Where hydraulic gradient exists check gradation to minimize migration. Clean groups suitable for use as drainage blanket and underdrain.
GP	Poorly graded gravels and gravel sand mixtures, little or no fines. 50% or more retained on No. 4 sieve. More than 95% retained on No. 200 sieve. Clean.	
SW	Well-graded sands and gravelly sands, little or no fines. More than 50% passes No. 4 sieve. More than 95% retained on No. 200 sieve. Clean.	
SP	Poorly graded sands and gravelly sands, little or no fines. More than 50% passes No. 4 sieve. More than 95% retained on No. 200 sieve. Clean.	

C. Class II material may be specified in the contract documents by the Engineer between the pipe embedment zone and the top 2 feet of final backfill when the trench is under the pavement.

2.05 CLASS III BACKFILL MATERIAL (Storm Sewer, Sanitary Sewer, and Water Mains)

A. Class III material is natural coarse-grained soils with fines.

B. Class III material consists of the following:

SOIL TYPE	DESCRIPTION OF MATERIAL CLASSIFICATION	REMARKS SECTION
GM	Silty gravels, gravel-sand-silt mixtures. 50% or more retained on No. 4 sieve. More than 50% retained on No. 200 sieve.	Do not use where water

GC	Clayey gravels, gravel-sand-clay mixtures. 50% or more retained on No. 4 sieve. More than 50% retained on No. 200 sieve.	condition in trench may cause instability.
SM	Silty sands, sand-silt mixtures. More than 50% passes No. 4 sieve. More than 50% retained on No. 200 sieve.	
SC	Clayey sands, sand-clay mixtures. More than 50% passes No. 4 sieve. More than 50% retained on No. 200 sieve.	

C. Compaction: See Section 31 23 16, 3.06.

2.06 CLASS IVA BACKFILL MATERIAL (Storm Sewer, Sanitary Sewer, and Water Mains)

A. Class IVA material is natural fine grained inorganic soils.

B. Class IVA material follows Section 31 23 16, 2.01, G and consists of the following:

SOIL TYPE	DESCRIPTION OF MATERIAL CLASSIFICATION	REMARKS SECTION
ML	Inorganic silts, very fine sands, rockflous, silty or clayey fine sands. Liquid limit 50% or less. 50% or more passes No. 200 sieve.	Obtain geotechnical evaluation of proposed material. May not be suitable under deep fills, surface applied wheel loads, and under heavy vibratory compactors and tampers. Do not use where water conditions in trench may cause instability.
CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays. Liquid limit 50% or less. 50% or more passes No. 200 sieve.	

C. Suitable only in dry trench conditions.

2.07 CLASS IVB BACKFILL MATERIAL (Storm Sewer, Sanitary Sewer and Water Mains)

A. Class IVB material is natural fine-grained inorganic (high elastic silts and plastic clays - fat clay) with a liquid limit greater than 50%.

B. Class IVB material follows Section 31 23 16, 2.01 and consists of the following:

SOIL TYPE	DESCRIPTION OF MATERIAL CLASSIFICATION	REMARKS SECTION

MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts. Liquid limit greater than 50%. 50% or more passes No. 200 sieve.	Not to be used in pipe embedment zone.
CH	Inorganic clays of high plasticity, fat clays. Liquid limit greater than 50%. 50% or more passes No. 200 sieve.	

C. When approved by the Engineer, Class IVB material may be used as final trench backfill in a dry trench.

D. Do not use in the pipe embedment zone.

2.08 CLASS V BACKFILL MATERIAL (Topsoil)

A. Class V Material is natural highly organic soils with a liquid limit greater than 50%. See Section 31 23 16, 2.01.

B. Use Class V Material only as topsoil outside of the pavement, unless otherwise specified or allowed by the Engineer.

C. Do not use Class V Material in the pipe embedment zone.

2.09 BEDDING AND BACKFILL MATERIALS FOR PIPE CULVERTS

A. Bedding:
   1. Use minimum Type C embedment (see plan details).
   2. Install water stop or curtain wall at culvert inlet, as specified in the contract documents.

B. Backfill Material:
   1. Use all suitable material excavated for pipe culvert work for backfill material.
   2. Dry suitable material that has excessive moisture prior to placement.
   3. Remove unsuitable material from the project site.

2.10 BEDDING AND BACKFILL MATERIALS FOR SUBDRAINS

A. Drainable Bedding and Backfill Materials Include:
   1. Porous backfill material.
   2. Pea gravel.
   3. Use as shown on the plans or on the detailed drawings.

B. Porous Backfill Material: Crushed stone or gravel with the following gradation.

Sieve	Percent Passing
3/4"	100
1/2"	95 to 100
3/8"	50 to 100
No. 4	0 to 50
No. 8	0 to 8

C. Coarse Aggregate: Use Stabilization Materials, per Section 31 23 16.

D. Pea Gravel: Use commercially available pea gravel.

E. Impervious Bedding: Use least permeable on-site materials.

F. Engineering Fabric: Use as acceptable to WisDOT standard specifications.

2.11 SPECIAL PIPE EMBEDMENT MATERIAL

A. Concrete Supports: Where specified in the contract documents, construct concrete support systems according to plans.

B. Concrete Bedding, Arch, or Encasement:
   1. Concrete: commercial, 4,000 psi compressive strength.
   2. Unreinforced, unless otherwise shown on the plans.
   3. Minimum concrete thickness: 6 inches or as shown on the plans.

C. Flowable Mortar:
   1. Approximate quantities per cubic yard:
      a. Cement 100 pounds
      b. Fly ash 300 pounds
      c. Fine aggregate 2,600 pounds
      d. Water, approximate 70 gallons
   2. Compressive strength at 28 days; 100 psi to 200 psi.

D. Controlled Low Strength Material (CLSM):
   1. Approximate quantities per cubic yard:
      a. Cement 50 pounds
      b. Fly ash 250 pounds
      c. Fine aggregate 2910 pounds
      d. Water, approximate 60 gallons
   2. Compressive strength at 28 days 50 psi.

PART 3 EXECUTION

3.01 PREPARATION

A. When natural soils for Class II, III, and IV backfill material is required as specified in plan details, provide written certification from a testing laboratory that the material meets the class specified if so requested by the Engineer.

B. Locate, mark, and protect existing utilities and facilities in the work area.

C. Provide access to utility service locations, such as valves, manholes, and utility poles.

D. Identify owners of utilities on or near the site, and notify them of operations to occur.

E. Protect existing facilities and landscaping features, or replace as shown on the plans.

F. Protect bench marks, control points and land survey monumentation, or replace at Contractor's expense.

3.02 TRENCH EXCAVATION

A. Notify the Engineer prior to the start of excavation activities.

B. Remove and stockpile the top 8 inches of topsoil for subsequent reuse.

C. Place excavated material away from trench. Grade spoil piles to drain. Do not allow spoil piles to obstruct drainage.

D. Remove rock, rubbish, boulders, debris, and other unsuitable materials at least 6 inches below,

and on each side of the pipe. Restore grade using soil suitable for backfill.

E. Correct unauthorized excavation at no cost to Owner, using bedding or stabilization materials.

F. Provide protective fences and barricades around open excavations, appropriate to the surrounding area.

G. Provide weight tickets for stabilization material to the Owner at the time of delivery.

H. Provide safety fence around open excavations.

I. Trench Excavation for Sanitary Sewers, Storm Sewers, Water Mains, and Pipe Culverts:
   1. Maximum and minimum pipe trench width: See plan details.
   2. Flat trench bottom, conduit bearing directly on trench bottom (not applicable for rock excavation) for water main pipe only with bell hole shaping:
      a. Shape trench bottom to support pipe around 1/4 of perimeter for the full length of the pipe barrel.
      b. Provide bell holes.
   3. Trench bottom, conduit supported by bedding material:
      a. Excavate trench as shown on the detailed drawings.
      b. Install bedding material to support the full length of the pipe barrel.
   4. Trench depth:
      a. See plan details.
      b. For those material types not shown in the plan details, the maximum height of bury will be 20 feet. Installations greater than 20 feet require submittal of licensed professional engineer trench design and certification.
   5. Conform all trench operations to current OSHA regulations.

J. Structure Excavation:
   1. For concrete structures and parts of structures without footings, 18 inches outside the horizontal projection of the structure.
   2. For concrete structures with footings, 18 inches outside the footings.
   3. For anchor rods, 12 inches on each side of the rod.
   4. For buried anchors, the face of the buried anchor on one side and 24 inches outside the buried anchor on the other face.

3.03 ROCK OR UNSTABLE SOILS IN TRENCH BOTTOM

A. Notify the Engineer prior to over-excavation.

B. Contractor will determine the need for trench bottom stabilization prior to installation of pipes and structures.

C. See plan details for over-excavation of rock and wet or soft foundations.

D. Provide weight tickets for the stabilization material to the Owner at the time of delivery.

3.04 SHEETING, SHORING, AND BRACING

A. Conform sheeting and bracing of all excavations to the latest state and federal regulations governing safety of workers in the construction industry.

B. Leave in place all temporary sheeting below 2 feet over top of pipe unless sheeting removal plan is approved by Engineer. Conform all trench operations to current OSHA regulations.

C. Move trench boxes carefully to avoid excavated wall displacement or damage.

D. When necessary or required, install adequate sheeting and bracing to prevent ground movement that may cause damage or settlement to adjacent structures, pipelines, and utilities.

E. Any damage due to settlement because of failure to use sheeting or because of inadequate bracing, or through negligence or fault of the Contractor in any other manner, shall be repaired

at the Contractor's expense.

F. For sides of trenches in unsuitable, loose, or soft material, shore, sheet, brace, slope, or otherwise support by means of sufficient strength to protect employees working within them.

G. Where excavations are made with vertical sides that require supporting, use sufficient strength for sheeting and bracing to sustain the sides of the excavations and to prevent movement that could in any way injure the work or adjacent structures, or diminish the working space sufficiently to delay the work

H. Select sheeting and bracing material of sufficient dimensions and strength to adequately support the sides of trenches and excavations, which will not split when driving and will be free of imperfections that may impair its strength or durability.

I. Drive sheeting to true alignment and ensure contact of adjacent pieces.

J. In wet excavation, use grooved sheeting to prevent passage of soil. Fill any voids between sheeting and face of excavation with suitable material.

K. Do not remove sheeting and bracing before the completion of the work, unless otherwise directed by the Engineer.

L. For sheeting left in place, cut off 18 inches for clearance below the bottom of the pavement in streets/highways and 18 inches below the original ground surface, unless otherwise required by the contract documents or the Engineer. Leave in place all temporary sheeting below 2 feet over top of pipe, unless a sheeting removal plan is approved by Engineer.

3.05 DEWATERING

A. Do all work in dry conditions; do not install pipes on excessively wet soil.

B. Perform the dewatering operation according to the dewatering plan submitted to the Engineer. Dewatering operations may be modified from the plan for actual field conditions, with approval of the Engineer.

C. Adequate dewatering is the Contractor's responsibility unless otherwise stated in the contract documents.

D. Install dewatering system appropriate for the soil conditions.

E. Maintain water levels sufficiently below the bottom of trench excavation, (typically 2 feet) to prevent upward seepage.

F. Provide for handling water encountered during construction:
   1. Prevent surface water from flowing into excavation. Remove water as it accumulates.
   2. Do not use sanitary sewers for disposal of trench water. Discharging water into storm sewers requires Engineer's approval.
   3. Do not discharge water onto adjacent property without property owner's approval.
   4. Maintain and control water discharge as necessary to prevent a safety hazard for vehicular and pedestrian traffic.
   5. Direct water discharge away from electrical facilities or equipment and intersections.
   6. Use noise and fume reducing dewatering equipment to minimize disturbance.
   7. Provide at least two operating pumps for each trench opened in wet ground, and at the same time have one pump in reserve.

G. Place backfill in trenches prior to stopping dewatering operations.

H. Protect trench water discharge points from erosion.

I. Operate dewatering systems to prevent damage to adjoining structures and facilities.

J. Monitor adjoining structures and facilities during dewatering operations. Cease dewatering

operations and notify the Engineer if damage is observed.

3.06 PIPE INSTALLATION

A. Refer to plans, as appropriate, for the installation. Use only the types of materials shown for each position within the trench, for the given groundwater conditions, for the compaction to be provided, and for the type of pipe being installed.

B. Pipe Bedding:
   1. Shape pipe bed to evenly support pipe at the proper line and grade, with full contact under the bottom of the pipe.
   2. Install pipe and system components.
   3. Place bedding simultaneously on both sides of the pipe. Correct any pipe displacements before proceeding.
   4. Place bedding in lifts no greater than 6 inches thick, consolidate, and moderately compact.
   5. Concrete encasement: Install where shown on the plans.
   6. If required in the contract documents or if approved by the Engineer, flowable mortar or controlled low strength material may be used in lieu of other bedding material types.
   7. Secure pipe against displacement or flotation prior to placing flowable mortar or concrete encasement.

C. Haunch Support:
   1. Place granular haunch material in lifts no greater than 6 inches thick, consolidate, and moderately compact by slicing with a shovel or using other approved techniques.
   2. If required in the contract documents, or if approved by the Engineer, concrete, flowable mortar, or controlled low strength material may be used instead of other haunch material types. Secure pipe against displacement or flotation prior to placing flowable mortar, controlled low strength material, or concrete encasement.

D. Primary and Secondary Backfill (Pipe Cover):
   1. Place pipe cover material in 6-inch lifts. Compact Class I and II (cohesionless) materials to a minimum of 65% Relative Density. Compact Class III and IVA (cohesive) materials to a minimum of 95% of maximum Standard Proctor Density.
   2. If required in the contract documents or if approved by the Engineer, flowable mortar or controlled low strength material may be used in lieu of other cover material types. Secure pipe against displacement or flotation prior to placing flowable mortar or concrete encasement.
   3. Special pipe support: If required, provide special pipe support as shown on the plans.

E. Final Trench Backfill:
   1. Place backfill in the trench immediately after recording locations of connections and appurtenances or at Engineer's direction.
   2. Place backfill adjacent to structures immediately after concrete has reached design strength and connecting work has been completed.
   3. Allow no more than 100 feet of trench to be open overnight or when work is not in progress except as provided on the plans.
   4. Place suitable excavated backfill:
      a. Carefully place backfill over top of pipe and around structures.
      b. Compact as required.
   5. Compaction:
      a. Within street right-of-way, compact each lift to a minimum of 65% Relative Density for Class I and II (cohesionless) materials and a minimum of 95% of maximum Standard Proctor Density for Class III and IVA (cohesive) materials.
      b. Outside of the street right-of-way, compact to a minimum of 50% Relative Density for Class I and II (cohesionless) materials and a minimum of 90% of maximum Standard

Proctor Density for Class III and IVA (cohesive) materials.

c. In areas more than 3 feet below pavement structure, place backfill in lifts no thicker than 8 inches.

d. In areas less than 3 feet below pavement structure, place backfill in lifts no thicker than 6 inches. Terminate backfill at 8 inches below finish grade in areas to remain unpaved, and to subgrade elevation in areas to be paved. Place 8 inches of topsoil in unpaved areas.

e. When crossing under levees, railroads, and State or Federal highways, comply with the compaction requirements of these jurisdictions, if more stringent than these requirements.

f. For Vitrified Clay Pipe (VCP), keep all heavy compaction equipment 5 feet above the top of the pipe. In the area less than 5 feet, use hand held compactors. Do not allow the compactor to come in contact with the pipe.

6. Moisture Range: Obtain required compaction within a soil moisture range of optimum moisture to 4% above optimum moisture content.
7. Dispose of surplus and unsuitable materials.
8. Hydraulic compaction (flooding with water) is not allowed.

F. Casing Pipe: Place bedding and backfill materials for casing pipe the same as for a rigid gravity flow pipe.

3.07 PIPE INSTALLATION IN CONSTRUCTED EMBANKMENTS

A. Install all pipes in trenches according to plans. When allowed by the contract documents, pipes may be constructed in embankments as follows:

B. Placing Pipe Sections:

C. Placing Backfill for Pipes:

1. Thoroughly tamp backfill under and around the pipe and in layers not to exceed 8 inches for the full length and width of the pipe.
2. Place backfill and thoroughly tamp around and over the pipe for its full length.
3. Extend the completed embankment on both sides of the pipe from the original ground line to at least 1 foot above the top of the pipe with a slope as shown in the contract documents. Construct the embankment over the pipe with a width no less than the outside diameter of the pipe and centered over the pipe. If necessary to accommodate construction traffic, increase the height of fill to the nominal diameter of the pipe or 3 feet, whichever is greater.
4. When pipe are laid wholly or partly in a trench, granular backfill material may be required for backfill. Compact the remainder of the fill to at least 1 foot above the top of the pipe with slopes as outlined above.
5. If the trench has been cut wide enough to permit use of a roller, after the pipe is bedded, thoroughly tamp the backfill material under and alongside the pipe with a mechanical tamper to the mid-height elevation of the pipe.
6. The contract documents may require placement of pipe with moisture control. When not required, place roadway pipe after construction of an embankment by methods that will produce results equivalent to those required for construction of the embankment, except that moisture determinations will be waived for placing backfill completed within 48 hours after excavation.
7. In addition to the normal backfill material requirements, when directed by the Engineer, build such approach fills to provide a roadway 10 feet in width over the pipe with grades

no steeper than 10%.

3.08 STRUCTURE BEDDING

A. Bedding for Structures Bearing on Undisturbed Soils:
   1. Shape the bottom to accurate grade and size.
   2. Remove loose material, large clods, stones, and foreign materials.
   3. In unstable soils or rock conditions, see Section specifications for stabilization requirements. Follow bedding requirements as shown in plans.

B. Bedding for Structures Bearing on Bedding Material:
   1. Over excavate to minimum of 8 inches or as specified in the contract documents.
   2. Place bedding material for structures according to the contract documents and with the material and control specified in Figure 312316.1.

3.09 STRUCTURE BACKFILL

A. Removal of Forms and Falsework:

B. Placement of Backfill: Place backfill after structure concrete has reached at least 80% of the design strength and connecting work has been completed, unless otherwise specified. Determine strengths under comparable conditions. If strength is not determined, place backfill after 14 days.

C. Backfill Against Walls and Around Structures:
   1. Where backfill is required on both sides of a concrete wall and around all sides of monolithic structures, proceed with filling operations simultaneously on all sides of walls and structures so the fill is kept at approximately the same elevation at all times. Consider concrete box, arch, and circular culvert monolithic structures.
   2. Compact the 3 feet closest to all walls or wing faces by pneumatic or hand tampers only.

D. Placing Backfill with Excavated Material:

E. Unless otherwise specified, see Section 312316, 3.06, D for suitable excavated materials for backfill.

3.10 OPEN CUT CASING PIPE INSTALLATION

A. Casing Pipe: Install casing pipe according to Specifications as appropriate.

3.11 FIELD QUALITY CONTROL

A. References:
   1. ASTM C 136; Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
   2. ASTM D 698; Standard Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Moisture Using 5.5 pound (4.54 kg) Rammer and 12 inch (305 mm) Drop. (Standard Proctor Method)
   3. ASTM D 1556; Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
   4. ASTM D 2216; Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.
   5. ASTM D 2922 and D 3017; Test Methods for Density of Soil and Soil-Aggregate in Place and Water Content of Soil and Rock by Nuclear Methods (Shallow Depth).
   6. ASTM D 4253 and D 4254, Test Methods for Maximum Index Density of Soils using a

Vibratory Table and Minimum Index Density of Soils and Calculation of Relative Density.

B. Compaction Testing: Provide compaction testing of backfill, using the services of an independent testing laboratory approved by the Engineer.

C. Schedule Testing: Notify Engineer when work is prepared for testing.

D. Soil Testing:
   1. Cohesive soils: Determine moisture-density relationships by ASTM D 698 (Standard Proctor). Perform at least one test for each type of cohesive soil used.
   2. Cohesive soils: Determine in-place density and moisture content using ASTM D 1556 (sand-cone method) and D 2216 or ASTM D 2922 and D 3017 (nuclear).
   3. Non-cohesive soils: Determine maximum and minimum index density and calculate relative density using ASTM D 4253 and D 4254 (cohesionless soils).
   4. Gradation: Test according to ASTM C 136.

E. Testing Frequency and Locations: Perform testing of the final trench backfill, beginning at a depth of 2 feet above the top of the pipe, as follows:
   1. Contractor provided:
      a. Make one test per each 2 vertical feet of consolidated fill at each street crossing.
      b. one test per each 2 vertical feet of consolidated fill for each 200 horizontal feet of trench.
      c. Additional testing may be required by Engineer if non-compliance or a change in conditions occur.
      d. Coordinate the timing of testing with the Engineer.
      e. The Engineer will determine the location of testing.
      f. If necessary, excavate to the depth and size as required by the Engineer to allow compaction tests. Place backfill and recompact.

F. Test Failure: Rework, recompact, and retest as necessary until specific compaction is achieved in all areas of the trench.

G. Retesting: In event of failed tests, Engineer may require retesting as deemed necessary. Costs of such retesting shall be paid by the Contractor, at no additional cost to the owner.

END OF SECTION

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SECTION 31 25 00
EROSION CONTROL

PART 1 - GENERAL

1.01 SCOPE

A. The work under this section consists of providing all work, materials, labor, equipment, and supervision necessary to provide and construct erosion control measures necessary to protect property and the environment.

1.02 RELATED WORK

A. Applicable provisions of Division 01 govern work under this Section.

B. Section 31 05 00 Common Work Results For Earthwork (Outside Building Footprint)

C. Provide erosion control in accordance with the following references:

1. Wisconsin Department of Natural Resources Technical Standards For Construction Site Erosion and Sediment Control. http://dnr.wi.gov/org/water/wm/nps/stormwater/techstds.htm

2. Erosion Control Product Acceptability List ("PAL"), current version as published by the WisDOT. http://wisconsindot.gov/Documents/doing-bus/eng-consultants/cnslt-rsrces/tools/pal/pal-8-11-2017.pdf

D. Method of measurement and basis of payment sections in any referenced erosion control documents shall not apply to this contract.

E. These documents are available from: State of Wisconsin Document Sales and Distribution 202 South Thornton Avenue; P.O. Box 7840; Madison, WI 53707; 608-266-3358

1.03 PERMITS

A. Contractor shall be responsible for obtaining and maintaining all erosion control permits associated with the project.

1.04 SUBMITTALS

A. The Lead Contractor will submit the following to the A/E:

1. Contractor shall mark-up of the Erosion Control Plan that is included in these documents showing additional or alternate erosion control measures as needed due to the Contractors means and methods throughout all phases of construction. The Contractor may also be required to submit calculations and backup information showing the proposed measures meet applicable regulations.

2. Submittals for materials used to implement the erosion control plan.

B. Submit shop drawings for the following erosion control features:

1. Silt Fence

2. Inlet Sediment Guards

3. Erosion Mat

1.05 EROSION CONTROL PLAN

A. The A/E has prepared an erosion control plan for the project and will apply for the required NOI permit. The Contractor will provide the A/E with submittals for materials used to implement the erosion control plan, as well as any modifications to the erosion control plan that are necessary due to the Contractor's means and methods of construction.

B. Contractor shall comply with all the requirements of the erosion control plan, and the Wisconsin Pollutant Discharge Elimination System, WPDES. The project specific WPDES Construction Site Stormwater Discharge Permit for Erosion Control and the City of Delevan and/or Walworth County Erosion Control Permit shall supersede the General Permit.

C. Erosion control and storm water management practices shall be installed and maintained in accordance with Walworth County, City of Delevan, and WDNR approved Technical Standards (or equivalent).

D. Contractor shall provide all erosion control practices necessary to protect property and the environment. Erosion control and storm water management practices shall be installed and maintained in accordance with the WDNR approved Technical Standards (or equivalent).

PART 2 - PRODUCTS

2.01 GENERAL

A. Erosion mats, soil stabilizers, and tackifiers shall be listed on the Product Acceptability List for Multi-Modal

B. Applications ("PAL") as published by the Wisconsin Department of Transportation.

C. When the design or contract includes permanent erosion control or stormwater control features, the contractor may employ these items in his control of erosion and stormwater during his construction activities. However, these items shall be fully cleaned, restored, and in every way fully functioning for its intended permanent use prior to acceptance of the work.

2.02 STRAW BALE BARRIERS

A. Rectangular bales of hay or straw, tightly bound with twine, not wire.

B. Anchor stakes shall be "T" or "U" steel posts, or hardwood, 2.0 by 2.0 inches nominal. Rebar shall not be used to anchor bales.

2.03 SILT FENCE

A. Fence fabric shall comply with the requirements of Standard Specifications for Highway Construction 628.2.6, in 3-foot-tall rolls, with 4' tall 2" x 2" nominal cross section hardwood posts spaced a maximum of 10' o.c. Silt fence shall be Mirafi, Trevira, Amoco, CFM, or approved equal.

2.04 EROSION MAT

A. A straw/coconut fiber mat encased in an accelerated photodegradable polypropylene top net. Erosion mat shall comply with the requirements of Class I, Type A erosion mat as defined by Standard Specifications for Highway Construction and the PAL. Erosion mat shall be American Excelsior, SI Geosolutions, Erosion Control Systems, North American Green, or approved equal.

B. Concentrated Areas/Channels (as indicated on plans): This mat shall be North American Green SC150 or approved equal.

C. Erosion Mat at Storm Outlets: This mat shall be ProPex LandLok 300 or approved equal.

D. Erosion Mat in bio-filtration and raingarden areas shall be North American Green SC-150BN or approved equal.

2.05 STAPLES

A. Use biodegradable staples in accordance with manufacturer's recommendations for materials being anchored. Wood and metal staples are not allowed.

2.06 RIP-RAP

A. Rip rap shall be the class specified and shall conform to Standard Specifications for Highway Construction Section 606.2.

2.07 TRACKING PAD STONE

A. The aggregate for tracking pads shall be 3 to 6 inch clear or washed stone. All materials shall be retained on a 3-inch sieve.

2.08 SOIL STABILIZERS

A. Soil stabilizers shall be non-asphalt-based products of the type specified, and meeting the requirements of the PAL.

2.09 SOIL TACKIFIERS

A. Soil tackifiers shall be non-asphalt-based products of the type specified, and meeting the requirements of PAL.

2.10 POLYMERS

A. Polymers used to settle suspended sediment shall meet the requirements of the WDNR Technical Standards.

PART 3 - EXECUTION

3.01 GENERAL

A. Install erosion control measures as required by the erosion control plan and contract documents. Provide additional erosion control measures as dictated by Contractor's means and methods, or by differing site conditions. Notify Construction Representative of additional erosion control features that are provided, but not shown on the plan.

B. Contractor shall provide all erosion control measures necessary to protect property and the environment. Include all erosion control measures as required by the most stringent of applicable sections of DNR Technical Standards or the Standard Specifications for Highway Construction.

C. Perform all work in accordance with manufacturer's instruction where these specifications do not specify a higher requirement.

D. Contractor shall comply with all the requirements of the erosion control plan, and if applicable, the WPDES Stormwater Discharge Permit for Erosion Control, including required monitoring and documentation.

3.02 GRADING AND EARTHWORK

A. Install all temporary or permanent erosion control measures prior to any onsite grading or land disturbances.

B. Clear only those areas designated for the placement of improvements or earthwork before placement of the final cover. Perform stripping of vegetation, grading, excavation, or other land disturbing activities in a logical sequence and manner which will minimize erosion. If possible, schedule construction for times of the year when erosion hazards are minimal.

C. Do not clear the site of topsoil, trees, and other natural ground covers before the commencement of construction. Retain natural vegetation and protect until the final ground cover is placed.

D. Temporary stockpiles are to be located greater than 25 feet from any roadway, parking lot, paved area, drainage structure, or channel.

E. Provide temporary stabilization and control measures (seeding, mulching, covering, erosion matting, barrier fencing, etc.) for the protection of disturbed areas and soil piles which will remain uncovered for a period of more than 7 consecutive calendar days.

F. Remove surplus excavation materials from the site immediately after rough grading. The disposal site for the surplus excavation materials shall also be subject to these erosion control requirements.

3.03 DRAINAGE

A. Minimize water runoff and retain or detain on-site whenever possible so as to promote settling of solids and groundwater recharge.

B. Convey drainage to the nearest adequate stormwater facility. Do not discharge water in a manner that will cause erosion or sedimentation of the site or receiving facility.

C. Protect storm sewer inlets and catch basins in accordance with the erosion control plan, if provided, a log with the WDNR Technical Standards and PAL. If not specified, protect inlets with straw bale barriers, silt fencing, filter basket, or other equivalent methods approved by the Engineer which provide the necessary erosion protection.

D. Divert roof drainage and runoff from all area’s upslope of the site around areas to be disturbed or channel them through the site in a manner that will not cause erosion.

E. Ditch checks are to be provided in swales or ditches to reduce the velocity of water in the channel. Construct in accordance to DNR Technical Standards and PAL.

F. Minimize the pumping of sediments when dewatering. Discharge to a sedimentation basin/trap or sedimentation vessel to reduce the discharge of sediments. Do not discharge water in a manner that will cause erosion or sedimentation of the site or receiving facility. Refer to section 31 23 19 Dewatering for specifications.

3.04 TRACKING CONTROL

A. Construct and maintain tracking pads in accordance with the Technical Standards. Provide each entrance to the site with a stone tracking pad at least 50 feet in length with a minimum thickness of 12 inches. The tracking pad shall be the full width of the egress point. Inspect tracking pads on a daily basis and replace aggregate when no longer effective.

B. If necessary, provide a crushed aggregate paved parking area.

C. If applicable, wash water shall be discharged to sedimentation basins, sedimentation vessels, or other such control areas.

3.05 MAINTENANCE

A. Inspect all erosion control measures within 24 hours of the end of each rainfall event that exceeds 0.25”, or daily during period of prolonged rainfall, or weekly during periods without rainfall. Immediately repair and/or replace any and all damaged, failed, or inadequate erosion control measures.

B. Re-apply soil stabilizers, tackifiers, polymers and anionic polycrylamides as needed to prevent erosion of exposed soil.

C. Maintain records of all inspections and any remedial actions taken.

D. Maintain stockpile stabilization measures as necessary after rainfall events and heavy winds. Replace tarps, re-seed, and reapply mulch, tackifiers and stabilizers, as necessary.

E. Remove sediment from stormwater and erosion control structures, basins, and vessels, as necessary.

F. Repair or replace damaged inlet protection.

G. Replace or supplement stone tracking pads with additional stone when they become ineffective.

H. Remove any sediment reaching a public or private roadway, parking lot, sidewalk, or other paved. Do not remove tracked sediments by flushing. Completely remove any accumulations not requiring immediate attention at least once daily at the end of the workday.

I. Frequently dispose of all waste and unused construction materials in licensed solid waste or wastewater facilities. Do not bury, dump, or discharge, any garbage, debris, cleaning wastes, toxic materials, or hazardous materials on the site, on the land surface or in detention basins, or otherwise allow materials to be carried off the site by runoff onto adjacent lands or into receiving waters or storm sewer systems.

END OF SECTION

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SECTION 32 05 00
COMMON WORK RESULTS FOR EXTERIOR IMPROVEMENTS

PART 1 - GENERAL

1.01 SCOPE

A. This section includes information common to all site work and applies to the entire contract.

B. Unless otherwise noted in the Contract Documents, Contractor shall be responsible for obtaining and paying for all permits necessary to complete the work.

C. Construction Limits are indicated on the drawings. In the absence of such a designation on the drawings, confine work to the minimum area reasonably necessary to undertake the work as determined by the Construction Representative. In no case shall construction activities extend beyond property lines or construction easements.

D. The Contractor shall restore all disturbed areas in accordance with the drawings and specifications. If plans and specifications do not address restoration of specific areas, these areas will be restored to pre-construction conditions as approved by the Construction Representative.

1.02 REFERENCE STANDARDS

A. Work under this section depends on applicable provisions from other sections and the plan set in this contract. Examples of related sections include, but are not limited to:

1. Division 31 — Earthwork

2. Specification 01 76 00 Protecting Installed Construction

B. AASHTO - American Association of State Highway and Transportation Officials

C. ACPA - American Concrete Pipe Association

D. ANSI - American National Standards Institute

E. ASCE - American Society of Civil Engineers

F. ASME - American Society of Mechanical Engineers

G. ASTM - American Society for Testing and Materials

H. AWWA - American Water Works Association

I. AWS - American Welding Society

J. FHA - Federal Highway Administration

K. EPA - Environmental Protection Agency

L. NEC - National Electric Code

M. NEMA - National Electrical Manufacturers Association

N. NFPA - National Fire Protection Association

O. NSF - National Sanitation Foundation

P. OSHA - Occupational Safety and Health Administration

Q. STI - Steel Tank Institute

R. UL - Underwriters Laboratories Inc.

S. WDNR - State of Wisconsin Department of Natural Resources

T. WisDOT - State of Wisconsin Department of Transportation

U. Where reference is made to the "SSHSC", it shall mean the pertinent sections of the State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction, current edition, and all supplemental and interim supplemental specifications. Where reference is made to the “BMPH”, it shall mean the Wisconsin Construction Site Best Management Practice Handbook, current edition as published by the WDNR. Method of measurement and basis of payment sections in referenced documents shall not apply.

PART 2 - PRODUCTS

2.01 BARRICADES, SIGNS, AND WARNING DEVICES

A. Traffic barricades, traffic signs, and warning devices shall meet the requirements of applicable OSHA standards and the FHA Manual of Uniform Traffic Control Devices (MUTCD).

B. Traffic signing materials shall meet the requirements of Sections 634, 636, and 637 of Standard Specifications for Highway Construction except that signs shall be from aluminum blanks.

C. Galvanized 2" round posts shall be provided for all signs.

2.02 TEMPORARY PLASTIC BARRIER FENCING

A. UV stabilized high-density polyethylene barrier fence free of holes tears and other defects. Provide 4’ tall fence in diamond or rectangular pattern. Fencing shall be “safety orange” color, unless otherwise noted.

B. Posts for temporary plastic barrier fencing shall be 5’ tall, minimum 12-gauge, painted metal posts.

PART 3 - EXECUTION

3.01 MAINTENANCE OF SITE AND BUILDING ACCESS/EGRESS

A. Unless otherwise shown or directed, maintain existing access and egress to the facility throughout construction. Maintain ANSI A117 compliant access for disabled persons, delivery access, emergency vehicle access, and emergency egress. Do not interrupt access and egress without prior written approval from the Construction Representative.

3.02 CONTINUITY OF EXISTING TRAFFIC/PARKING AND TRAFFIC CONTROL

A. Do not interrupt or change existing traffic, delivery, or parking without prior written approval from the Construction Representative. When interruption is required, coordinate schedule with the Owner agency to minimize disruptions. When working in public right-of-way, obtain all necessary approvals and permits from the City of Delevan.

B. When Contractor's activities impede or obstruct traffic flow, Contractor shall provide traffic control devices, signs, and flaggers in accordance with other Contract Documents and the current version of the MUTCD, or as shown on the Drawings.

3.03 PROTECTION AND CONTINUITY OF EXISTING UTILITIES

A. Verify the locations of any water, drainage, gas, sewer, electric, drainage, gas, sewer, electric, telephone/communication, fuel, steam lines or other utilities and site features which may be encountered in any excavations or other sitework. All lines shall be properly underpinned and supported to avoid disruption of service.

B. Do not interrupt or change existing utilities without prior written approval from the Construction Representative, affected utilities and users. Notify all users impacted by outages a minimum of 48 hours in advance of outage. Notification shall be provided in writing and describe the nature and duration of outages and provide the name and number of Contractor's foreperson or other contact.

C. Any service connections encountered that are to be removed shall be cut off at the limits of the excavation and capped in accordance with the requirements of applicable codes and any specifications governing such removals.

3.04 PROTECTION OF EXISTING WORK AND FACILITIES

A. Verify the locations of, and protect, any signs, paved surfaces, buildings, structures, landscaping, streetlights, utilities, and all other such facilities that may be encountered or interfered with during the progress of the work. Take measures necessary to safeguard all existing work and facilities that are outside the limits of the work or items that are within the construction limits but are intended to remain. Report any damage to existing facilities to the Construction Representative immediately. Correct and pay for all damages.

3.05 CONSTRUCTION LAYOUT

A. Contractor shall establish all heights and grades to properly execute work from benchmark established by a surveyor (from original survey work). It is strongly recommended that the design engineering firm be contacted and used for all construction layout as well as as-built surveys in an effort to avoid conflict between datums and horizontal control points used. Prior to construction layout, existing and proposed finished floor elevations shall be checked with respect to current site benchmarks to ensure elevations correspond with layout elevations.

B. Contractor shall provide all construction layout surveys to accurately locate the construction on the site.

3.06 STORMWATER/EXCAVATION WATER MANAGEMENT

A. Control grading around structures, pitch ground to prevent water running into excavated areas.

B. Pits, trenches within building lines and other excavations shall be maintained free of water.

C. Provide trenching, pumping, other facilities required.

D. Notify Architect/Engineer if springs or running water are encountered in excavation; provide discharge by trenches, drains, pumping to point outside of excavation. Provide information to Architect/Engineer of points and areas that water will be discharged. At the Engineer's option, the Contractor shall drain the spring to the storm sewer system by the use of field tile.

E. Be responsible for control measures to prevent damage from flooding, erosion, and sedimentation to on-site and off-site areas.

END OF SECTION

SECTION 32 11 23.33
DENSE GRADED BASE

PART 1 - GENERAL

1.01 SCOPE

A. This section includes information common to dense graded base using crushed stone or crushed gravel and applies to all sections in this Division.

1.02 REFERENCE STANDARDS

A. Work under this section depends on applicable provisions from other sections and the plan set in this contract. Examples of related sections include, but are not limited to:

1. Division 31 — Earthwork

B. Wherever WisDOT or SSHSC appears in this specification it shall be construed to mean the pertinent sections of the State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction (SSHSC), current edition, and all supplemental and interim supplemental specifications, as they may pertain, except this contract shall be a lump sum contract and measurement and basis of payment methods shall not apply.

C. Dense Graded Base shall conform to City and/or County standard specifications for Crushed Aggregate Base Course.

1.03 SUBMITTALS

A. Provide copies of record drawings.

B. Provide copies of material testing reports.

C. Provide the following prior to construction:

1. Manufacturer’s product information (cut sheets)

2. Mix designs and specifications

3. Aggregate Gradations

D. Materials conforming to the WisDOT Standard Specifications for Highway and Structure Construction (Latest Edition, hereafter called “Standard Specifications for Highway Construction” and supplied from a WisDOT approved source need not be tested. The contractor shall furnish evidence of such WisDOT approval to the A/E and/or Construction Representative.

E. Maintain record drawings showing actual locations of utilities and other features encountered, modifications to proposed grades and site features, and other deviations from the original design.

PART 2 - PRODUCTS

2.01 GENERAL

A. Use dense graded base. Materials shall conform to Section 301.2 of the WisDOT Standard Specifications for Highway and Structure Construction. Material gradations shall conform to Section 305.2.2 of the WisDOT Standard Specifications for Highway and Structure Construction unless specified elsewhere in the contract documents.

B. Base Course Gradation: 1-1/4” Crushed Aggregate

C. Materials shall conform to City and/or County specifications.

2.02 BREAKER RUN AGGREGATE

A. Crushed stone, rock or gravel meeting the requirements of either Breaker Run or Select Crushed material as defined in Section 311.2 or Section 312.2 of Standard Specifications for Highway Construction, respectively.

PART 3 - EXECUTION

3.01 CONSTRUCTION

A. Preparing The Pavement Foundation (Sub-Grade):

1. Prepare the foundation, or resurface the previously placed base layer, as specified in WisDOT Section 211 before placing base. Do not place base foundations that are soft, spongy, or covered by ice or snow. Water and rework or re-compact dry foundations as necessary to ensure proper compaction, or as the representative designates.

    a. In proposed pavement areas, all organic solids shall be removed.

    b. Excavation shall be reasonably free of water prior to beginning filling. Do not place material on frozen surfaces or use frozen material.

    c. In areas of existing pavement to be modified or adjusted in grade, the existing pavement section shall be removed by an acceptable method. The new pavement section shall match the construction details.

    d. Place and compact material to minimize settlement and avoid damage to structures, pipes, utility lines and other features. Hand place and compact material as necessary.

    e. Moisture condition backfill material as necessary to achieve density required for given use.

    f. Compact fill material as required for the given use.

    g. It is the responsibility of the Contractor to provide all necessary compaction equipment and other grading equipment that may be required to obtain the specified density. Vibratory plate or tamping type walk behind compactors will be required whenever backfill is placed adjacent to structures, pipes, utility lines and other features.

h. Where additional filling or excavation is necessary, or placement of base course will be delayed, roll surface of proposed roadway or parking lot with a smooth drum roller to provide relatively impervious surface and promote drainage.

2. Proof-roll all subgrade areas that are to receive aggregate base or pavement. Proof-roll with a loaded dump truck prior to the placement of base courses to locate soft spots that yield under loading. Over excavate (undercut) areas of soft subgrade that will not compact readily when proof-rolled or tamped. Backfill with breaker run or select crushed material as approved by the project representative.

   a. Prior to undercutting or excavating below subgrade (EBS) or placing any base course, contact the Construction Representative to schedule inspection of subgrade and proof-rolling. Provide minimum of 24 hours confirmed notice. All proof-rolling shall be completed in the presence of the Construction Representative and Geotechnical Consultant.

   b. To complete proof-rolling, entire roadway subgrade shall be provided with a relatively smooth surface, suitable for observing soil reaction during proof-rolling.

   c. Contractor shall schedule and provide a fully loaded tri-axle dump truck for proof-rolling. Loaded truck shall have a minimum gross operating weight of 30 tons. Test shall be conducted with “tag” or “pusher” axles retracted from the ground.

   d. Test-rolling shall be accomplished in a series of traverses parallel to the centerline of the street or parking area. The truck shall traverse the length of the street or parking area once for each 12’ of width. Additional passes along the traverse shall be completed as directed by the Geotechnical Consultant, to further define unsatisfactory subgrade.

   e. Soft areas, yielding areas, cracked areas or areas where rolling or wave action is observed shall be considered indicative of an unsatisfactory subgrade. Such areas shall be undercut as outlined in Section 31 05 00.

   f. Once the subgrade has been proof-rolled and approved, protect the soils from becoming saturated, frozen, or adversely altered.

   g. Contractor shall assume 15% of proposed paved areas may require undercutting. This work shall be included in base bid. Undercut as outlined in Section 31 05 00.

B. Stockpiling:

1. If continuous compliance with material specifications is questionable, the project representative may require the contractor to supply material from a stockpile of previously tested material. Maintain a sufficiently large stockpile to preclude the use of material not previously approved.

2. Build and maintain stockpiles using methods that minimize segregation and prevent contamination. If the contract specifies location, place stockpiles where specified. Clear and prepare stockpile areas to facilitate the recovery of the maximum amount of stockpiled material.

C. Constructing Base:

1. Place aggregate in a manner that minimizes hauling on the subgrade. Do not use vehicles or operations that damage the subgrade or in-place base. Deposit material in a manner that minimizes segregation.

2. Construct the base to the width and section the plans show. Shape and compact the base surface to within 0.04 feet (12 mm) of the plan elevation.

3. Ensure there is adequate moisture in the aggregate during placing, shaping, and compacting to prevent segregation and achieve adequate compaction.

4. Maintain the base until paving over it, or until the project representative accepts the work, if paving is not part of the contract. The contractor is not responsible for maintaining material placed on detours.

D. Standard Compaction: Compact the base until there is no appreciable displacement, either laterally or longitudinally, under the compaction equipment. Route hauling equipment uniformly over previously placed base. Compact each layer before placing a subsequent layer. If the material is too dry to readily attain the required compaction, add water as necessary to achieve compaction

E. Special Compaction: If the contract requires special compaction, compact each layer to 95 percent of maximum density, or more, before placing the subsequent layer. The geotechnical engineer will determine the maximum density according to AASHTO T 99 method C or D and in-place density according to AASHTO T 191.

F. Controlling Dust: Apply water or other engineer-approved dust control materials to control dust during construction and maintenance of the base and shoulders.

3.02 COMPACTION

A. Compact each base layer, including shoulder foreslopes, with equipment specified in WisDOT Section 301.3.1. Use standard compaction conforming to WisDOT Section 301.3.4.2. Final shaping of shoulder foreslopes does not require compaction.

B. Compacting 1 1/4-Inch Base and 3/4-Inch Base. If using a pneumatic roller, do not exceed a compacted thickness of 6 inches (150 mm) per layer. For the first layer placed over a loose sandy subgrade, the contractor may, with the geotechnical engineer's approval, increase the compacted layer thickness to 8 inches (200 mm). If using a vibratory roller, do not exceed a compacted thickness of 8 inches (200 mm) per layer.

C. Compacting 3-Inch Base: Compact with a vibratory or pneumatic roller. Do not exceed a compacted thickness of 9 inches (225 mm) per layer.

3.03 UNDERCUTTING/EXCAVATION BELOW SUBGRADE (EBS)

A. Undercutting/EBS shall be completed only when directed by the Geotechnical Consultant. The Contractor shall not be compensated for any unauthorized undercutting/EBS. Measure and document undercut areas and depths in consultation with Geotechnical Consultant. Work shall comply with Section 31 05 00. Contractor shall assume 50% of proposed driveway paved areas may require undercutting. This work shall be included in unit prices with bid item 90002.

3.04 CLEANUP

A. After the project is completed, thoroughly clean up all debris that may have accumulated during the placement of dense graded base. Replace or repair as required, all surfaces and/or landscape features damaged or disturbed under this item of work.

END OF SECTION

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SECTION 32 12 00
ASPHALTIC PAVEMENT

PART 1 - GENERAL

1.01 SCOPE

A. This section includes information common to bituminous concrete paving work as shown on the drawings and applies to all sections in this Division.

1.02 REFENCE STANDARDS

A. Work under this section depends on applicable provisions from other sections and the plan set in this contract. Examples of related sections include, but are not limited to:

1. Division 31 — Earthwork

B. City and/or County Standard Specifications for Public Works Construction.

C. Part 4, “Pavements” of the latest edition of the Standard Specifications for Highway and Structure Construction of the State of Wisconsin, Department of Transportation.

1.03 SUBMITTALS

A. Results from the Freeze / Thaw Test (AASHTO T103) for quarried course aggregates used in the work produced from limestone/dolomite sources. The maximum percent loss for aggregates used in the work shall be four percent (4%).

B. Asphalt Pavement mix designs in accordance with the aforementioned Part 4 of the latest edition of the Standard Specifications for Highway and Structure Construction of the State of Wisconsin, Department of Transportation. The asphaltic materials used shall comply with the current City and/or County specifications for Asphalt Construction.

1.04 QUALITY ASSURANCE

A. Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:

1. Tack Coat: Minimum surface temperature of 60°F.

2. Asphalt Base Course: Minimum surface temperature of 40°F and rising at time of placement.

3. Asphalt Surface Course: Minimum surface temperature of 60°F at time of placement.

B. Pavement Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40°F for oil-based materials, and not exceeding 95° F.

C. The paving crew shall be under the supervision of an experienced supervisor who shall be on the project at all times, and who shall not operate equipment, such as paving machines or rollers, at any time during the paving operation. Under no circumstances

shall the workers, or others, be allowed to walk across recently laid asphalt mixture behind the paving machine and ahead of the roller.

D. A mechanical vibratory plate compactor shall be available on the job site at all times during asphalt pavement placement and shall be used for compaction around access structures, catch basins, water valves and other castings which appear in the paved areas. The mechanical vibratory plate compactor shall be equipped with a working water reservoir and shall be of sufficient size and capability to attain the compaction requirements of these specifications.

E. Asphalt mixtures intended for use on City projects will be tested by the City to determine aggregate gradations, asphalt content, air voids and VMA. Asphalt mixtures shall be tested per section 460.2.8 of the latest edition of the Standard Specifications for Highway and Structure Construction of the State of Wisconsin, Department of Transportation

PART 2 - PRODUCTS

2.01 MATERIALS

A. The materials intended for use in base, lower, and upper layer mixtures, tack and seal coats, surface treatments, and similar work, shall comply with the requirements of Part 4, “Pavements” of the latest edition of the Standard Specifications for Highway and Structure Construction of the State of Wisconsin, Department of Transportation.

B. The Contractor shall provide Asphalt Pavement mix designs in accordance with the aforementioned Part 4 of the latest edition of the Standard Specifications for Highway and Structure Construction of the State of Wisconsin, Department of Transportation. The asphaltic materials used shall comply with the current City and/or County specification for Asphalt Construction.

2.02 RECYCLED ASPHALTIC MATERIALS

A. The contractor may use recycled asphaltic materials from FRAP, RAP, and RAS in HMA mixtures. Stockpile recycled materials separately from virgin materials and list each as individual JMF components.

B. Control recycled materials used in HMA by evaluating the percent binder replacement, the ratio of recovered binder to the total binder. Conform to the following:

Maximum Allowable Percentage Binder Replacement		
Recycled Asphaltic Material	Lower Layers	Upper Layer
RAS if used alone	25	20
RAP and FRAP in any combination	40	25
RAS, RAP and FRAP in	35	25

combination		
When used in combination the RAS component cannot exceed 5 percent of the total weight of the aggregate blend.		

C. This work shall consist of the construction of a plant mixed recycled asphalt mixture furnished and placed all in accordance with Article 460 of the latest edition of the Standard Specifications for Highway and Structure Construction of the State of Wisconsin, Department of Transportation, except as listed below.

D. The City shall approve the sources of recycled asphalt material, including shingles.

2.03 ASPHALT TACK COAT

A. Unless otherwise specified in the contract, or directed by the Engineer, the types and grades of asphalt materials and rates of applications in gallons per square yard and shall be type MS-2, SS-1, SS-1h, CSS-1, or an approved modified emulsified asphalt.

B. For existing concrete or asphalt pavements, the rate of application shall be between 0.05 and 0.10 gallons per square yard.

PART 3 - EXECUTION

3.01 SPREADING AND FINISHING

A. Pave at a constant speed, according to the paver specifications and mixture, for uniform spreading and strike-off with a smooth, dense texture and no tearing or segregation. In any event, the speed of placing asphalt mixtures shall not exceed that which coincides with the average rate of delivery to the paver, so as to provide as nearly as possible continuous operation of the paver.

B. The roller shall pass over an unprotected end of freshly laid mixture only when the laying of the course is to be discontinued long enough to permit the mixture to become cooled. In the event of such discontinuance, the end of the course shall be treated as a transverse construction joint as specified below.

3.02 COMPACTION

A. Where the edges are not supported by a curb and gutter or similar structure, the outside edges of the lower and upper layers shall be sloped and pressed in place by means of a self-adjusting constant pressure edge plate held in proper position on the finishing machine. A string line shall be used as a guide for the finishing machine in order to maintain a uniform edge alignment. If any other method is used, it shall meet the approval of the Engineer. The edge of the pavement shall be sloped approximately one (1) inch from the vertical and no material shall extend beyond the limits of the base. Irregularities in alignment along the outside edges and along the longitudinal joints shall be corrected by adding or removing paving mixtures before the edges are rolled.

B. The mixture shall be spread sufficiently so that after compaction the finished surface shall be one-eighth (1/8) to one-fourth (1/4) inch above the edges of curbs, gutters, access structures and similar structures. Each roller, while the paving is under way, shall be kept as nearly as practicable in continuous operation and the speed shall at all times be slow

enough to avoid undue displacement of the mixture. When pneumatic-tired rollers are used, they shall be operated continuously at a rate of speed which will not cause damage to the mat and which will provide the maximum number of coverages possible while the temperature of the mat is conducive to densification and surface sealing. Rollers shall be operated with the drive roll or wheels nearest the paver.

C. Each roller, while the paving is under way, shall be kept as nearly as practicable in continuous operation and the speed shall at all times be slow enough to avoid undue displacement of the mixture. When pneumatic-tired rollers are used, they shall be operated continuously at a rate of speed which will not cause damage to the mat and which will provide the maximum number of coverages possible while the temperature of the mat is conducive to densification and surface sealing. Rollers shall be operated with the drive roll or wheels nearest the paver.

Minimum Required Density		
Layer	Percent of Target Maximum Density	
	Mixture Type	
	E-0.3, E-1, E-3	E-10
Lower	91.5	92
Upper	91.5	92

3.03 JOINTS

A. Longitudinal joints including mainline interior joints for all pavement layers shall be “hot” joints. “Hot” joints will be defined as joints with a temperature at or above the asphalt mixture compaction temperature. The Contractor shall provide the compaction temperature as part of the mix design submittal.

B. Where reheating of joints is needed to create a “hot” joint, reheating equipment and methods shall be in accordance with the latest edition of the Standard Specifications for Highway and Structure Construction of the State of Wisconsin, Department of Transportation, specifically Reheating HMA Pavement Longitudinal Joints, Item 460.4100S.

C. Where “Michigan” joints are placed to allow traffic use, the joint shall be milled, reheated, and tacked in accordance with the above stated reheating specification before continuation of paving.

D. Contractor’s operations shall not result in additional transverse joints unless approved by the Engineer.

3.04 ASPHALT PAVEMENT

A. Unless otherwise specified or directed by the Engineer, asphalt driveways and asphalt terrace paving shall be constructed of three (3) inches of upper layer pavement installed in one (1) lift on select fill, or as directed by the Engineer. E-0.3 mixture with 9.5mm nominal aggregate size or an approved commercial mix shall be used unless a substitute is approved by engineer.

B. The composition for the various asphalt mixtures shall conform to the limits specified in Part 4 of the latest edition of the Standard Specifications for Highway and Structure Construction of the State of Wisconsin, Department of Transportation. Warm mix HMA is not approved.

C. The mixture shall be laid and compacted so that the average yields in pounds per square yard shall conform to the following charts showing the various thicknesses of installation:

Upper & Lower Layer(s) Yield-#S.Y.		
Thickness	Min.	Max.
1.5”	172	180
1.75”	201	210
2”	230	240
2.5”	287	300
3”	345	360
4”	460	480
5”	575	600

D. Unless otherwise specified in the contract, or directed by the Engineer, the upper layer mixtures shall be installed in one course of one and one-half (1-3/4) inches in depth.

E. For installations of the upper layer which are specified to be other than one and one-half (1-1/2) inches in depth, the allowable yields for such installations shall be in proportion to the allowable yields specified above.

F. Whenever the yields fall below the minimum allowable yields specified above, the Engineer shall determine the corrective action to be taken. The corrective action may include removal and replacement of the area of deficient thickness, an overlay with approved material of the area of deficient thickness, or such other action as the Engineer shall determine. The area of deficient thickness shall be determined on the basis of

project area or area covered in one day's operation, whichever is less. The Engineer's determination will be based on the circumstances of the area involved and will include a determination of the distribution of costs of the corrective work required.

END OF SECTION

SECTION 32 13 00
CONCRETE WORK OUTSIDE THE BUILDING ENVELOPE

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: Cast-in-place concrete required for this Work is indicated on the drawings and includes, but is not necessarily limited to:

PART 1 – General
- Scope
- Quality Assurance
- Submittals
- Product Handling
- Reference Specifications
- LEED Certification Requirements

PART 2 – Products
- Concrete Materials
- Miscellaneous Materials
- Mixes and Delivery
- Detectable Warning Field

PART 3 – Execution
- Field Quality Control
- Preparation
- Concrete Placement
- Concrete Joints
- Expansion/ Isolation Joints
- Concrete Curing and Protection
- Tolerances
- Dense Graded Base
- Concrete Curb and Gutter
- Concrete Sidewalks, Pads and Driveways
- Curb Ramps
- Miscellaneous Concrete and Cement Work

B. Provide all work, materials, labor, equipment, and supervision necessary.

C. Related work described elsewhere:

Section 31 05 00	Common Work Results for Earthwork (Outside the Building Footprint)
Section 32 11 23.33	Dense Grade Base

1.02 QUALITY ASSURANCE

A. All work shall be in accordance with applicable manufacturer's and supplier's instructions.

B. Qualifications of Workers:

1. Provide at least one person who will be present at all times during execution of this portion of the work who is thoroughly trained and experienced in placing the types of concrete specified and who will direct all work performed under this Section.

2. For finishing of exposed surfaces of concrete, use only thoroughly trained and experienced concrete finishers.

3. Concrete field tests for water content, slump, air content, yield and strength cylinders shall be conducted by a certified Wisconsin Concrete Technician, or technician of equivalent

certification.

C. Correction of Defective Work: All concrete work which does not conform to the requirements of the Contract Documents and ACI 301, including function, durability, appearance, strength, cracking, tolerances, and finishing, shall be corrected as directed by Architect at Contractor's expense. Additional testing, engineering, reinforcement and removal and replacement of defective concrete shall be paid for by Concrete Contractor. Contractor shall also be responsible for the cost of corrections to any other work affected by or resulting from corrections to the concrete work.

1. Concrete repairs including, but not limited to, patching, epoxy injection, routing, and sealing, shall be performed by a specialty repair/restoration contractor, certified by the material supplier.

a. Provide qualifications to Architect and Structural Engineer for review and approval.

b. Restoration contractor shall provide material lists and describe means and methods to Architect and Structural Engineer for review, prior to commencement of work.

c. Acceptance of units, repaired pursuant to written approval, is contingent upon repairs being skillfully done so as to be sound, permanent, flush with adjacent surfaces and, when exposed, of color and texture matching similar adjoining surfaces and showing no apparent line of demarcation between original and repaired work.

1.03 SUBMITTALS

A. Materials List: Within 30 days after award of Contract, and before any concrete is delivered to the job site, submit to Architect, in accordance with General Conditions, a complete list of all materials proposed to be furnished and installed under this portion of the Work, showing manufacturer's name and catalog number of all items such as admixture and membrane, and the name and address of transit-mix concrete supplier. Prior to starting construction, General Contractor shall also furnish a statement to Architect giving source, sieve analysis and specific gravity of both fine and coarse aggregate, proportions by weight (dry) of cement, fine and coarse aggregates, admixtures, and water that will be used in the manufacture of each class of concrete specified. No change in source of materials shall be made without prior notification to Architect.

B. Concrete Mix Design: Submit Mix Design to Architect for review. This submittal shall include the following:

1. Required cylindrical compression strength for f'c (28 day).

2. Element (curb, driveway, etc.) in which each class (strength of concrete) will be used.

3. Cylinder compressive strength test results or complete standard deviation analysis in accordance with ACI 318 Section 5.3.

4. Proportions of Materials.

5. Source of materials - Cement (type and brand), gravel pit.

6. Aggregate size and certification from an independent testing lab that gradation, specific gravity, soundness, absorption, and impurities meet ASTM requirements.

7. Admixture brand, dosage, literature.

8. Air content.

9. Water content and target slump.

10. Range of ambient temperature and humidity for which design is valid.

11. Special characteristics of mix which require precautions in mixing, placing, or finishing techniques to achieve finished product specified.

C. Product Data: Submit manufacturer's product data for review with application and installation instructions for proprietary materials and items including: patching compounds, epoxies, curing compounds, dry-shake finish materials, hardeners, sealers etc. for all items specified and used in materials list.

D. Substitutes to Specified Items:

1. Provide all product literature for substitutes to Architect for review.

2. Manufacturer's Representative shall certify in writing that the proposed substitute product meets or exceeds all requirements, test results, etc. in the Specification and the specified product's literature. Provide test results performed by an independent testing agency using the same test methods.

3. Specify amount of credit to owner if substitute is approved.

E. Construction Joints: Submit drawing of proposed construction joints for review for slabs on grade if different from those shown on drawings or if none shown on drawings.

F. Transit-mix delivery slips: With each load of concrete delivered to job, there shall be furnished by ready-mixed concrete producer duplicate delivery tickets, one (1) for Contractor and one (1) for Owner's representative. Delivery tickets shall provide following information:

1. Date

2. Name of ready-mixed concrete plant

3. Job location

4. Contractor

5. Type (Standard, A.E. or H.E.S.) and brand name of cement

6. Class and specified cement content in pounds per cubic yard of concrete

7. Truck number

8. Time dispatched

9. Amount of concrete in load in cubic yards

10. Admixtures in concrete

11. Maximum size of aggregate

12. Water added at job, if any.

13. Make the record available to Architect for inspection upon request.

G. Provide samples of broomed finish, stamped patterns, and dye colors.

H. Provide copies of all quality assurance testing reports.

I. Provide manufacturers product information (cut sheets) for truncated domes.

J. Sample Color Samples for Architectural Concrete (if applicable)

1. Provide to Architect for review 18" x 18" x 2" samples of concrete made with cement from various manufacturers for color selection and to establish the "Design Reference Standard" per ACI 303.1. Each sample shall be marked with name of cement manufacturer and type of aggregate used. Provide one (1) screed finish and one (1) trowel finish sample of each type. Color as selected by Architect.

2. Before any forms are constructed for exterior or exposed architectural concrete, erect sample wall panel of size shown on drawings, or of size sufficient to show full range of finishes, showing both vertical board and smooth finish surfaces, and meeting the requirements of ACI 301 and 303.1. No work shall proceed until sample has been approved by Architect.

1.04 PRODUCT HANDLING

A. Protection: Use all means necessary to protect cast-in-place concrete materials before, during and after installation and to protect the installed work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of Architect at no additional cost to Owner.

C. Do not use aluminum pipe if concrete is to be transported by means of pumping. Aluminum will not be allowed in concrete.

1.05 REFERENCE SPECIFICATIONS

A. The following latest edition reference specifications, guides and standards shall become part of this specification as if herein written. If provisions conflict, the more stringent provisions shall apply.

ACI 117 - Specifications for Tolerances for Concrete Construction and Materials and Commentary.

ACI 211.1 - Recommended Practice for Selecting Proportions for Normal Mass and Heavyweight Concrete.

ACI 211.2 - Recommended Practice for Selecting Proportions for Lightweight Concrete.

ACI 212 - Chemical Admixtures for Concrete.

ACI 214 - Recommended Practice for Evaluation of Results of Tests used to Determine the Strength of Concrete.

ACI 302.1 - Guide for Concrete Floor and Slab Construction.

ACI 303.1 - Standard Specification for Cast-In-Place Architectural Concrete.

ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.

ACI 304.2R - Placing Concrete by Pumping Method

ACI 305.1 - Specification for Hot Weather Concreting ACI 306 - Cold Weather Concreting.

ACI 306.1 - Standard Specification for Cold Weather Concreting.

ACI 308.1 - Standard Specification for Curing Concrete.

ACI 309 - Recommended Practice for Consolidation of Concrete.

ACI 318 - Building Code Requirements for Reinforced Concrete.

ACI ITG-4.1 - Specification for High-Strength Concrete in Moderate to High Seismic Applications (IBC Seismic Design Categories C-F)

ASTM C 31 - Method of Making and Curing Concrete Specimens in the Field.

ASTM C 33 - Standard Specification for Concrete Aggregate.

ASTM C 39 - Test Method for Compressive Strength of Cylindrical Concrete Specimens.

ASTM C 94 Standard Specification for Ready-Mixed Concrete.

ASTM C 138 - Standard Method of Test for Weight per Cubic Foot, Yield, and Air Content (Gravimetric) of Concrete.

ASTM C 143 - Standard Method of Test for Slump of Portland Cement Concrete.

ASTM C 150 - Specification for Portland Cement. ASTM C 171 - Sheet Materials for Curing Compound. ASTM C 172 - Method of Sampling Fresh Concrete.

ASTM C 173 - Standard Method of Test for Air Content of Freshly Mixed Concrete by the Volumetric Method.

ASTM C 192 - Standard Method of Making and Curing Concrete Test Specimens in the Laboratory.

ASTM C 231 - Standard Method of Test for Air Content of Freshly Mixed Concrete by the Pressure Method.

ASTM C 260 - Specification for Air-Entraining Admixtures for Concrete.

ASTM C 330 - Standard Specification for Lightweight Aggregates for Structural Concrete

ASTM C 494 - Specification for Chemical Admixtures for Concrete.

ASTM C 595 - Specification for Blended Hydraulic Cements.

ASTM C 618 - Specification for Fly Ash and Raw or Calcinated Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.

ASTM C989 - Standard Specification For Slag Cement For Use in Concrete and Mortars.

ASTM C1017 - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.

OSHA Standard "Safety and Health Regulations for Construction", Part 1926 Subpart Q: "Concrete and Masonry Construction."

ANSI A10.9 "Safety Requirements for Concrete Construction and Masonry Work."

Standard Specification for Highway and Structure Construction, State of Wisconsin.

AASHTO T 318 - "Standard Method of Test for Water Content of Freshly Mixed Concrete Using Microwave Oven Drying".

1.06 LEED CERTIFICATION REQUIREMENTS

A. Ready-mixed concrete including coarse and fine aggregate shall be supplied within a 500-mile radius of the Project site.

B. Liquid materials including sealers, hardeners, curing compounds, etc., shall be VOC-compliant (low-odor or zero- odor type).

C. LEED SUBMITTALS. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

1. Recycled Content: MR4

   a. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.

   b. Indicate relative dollar value of recycled content product to total dollar value of product included in project.

   c. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight.

   d. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.

   e. If any fly ash, slag cement, silica fume, or other waste material is used in mix designs to replace Portland cement, submit the total volume of concrete cast in place and mix design(s) used showing the quantity of Portland cement replaced. Use LEED New Product Content Form.

2. Local/Regional Materials: MR5

   a. Sourcing location(s): Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.

   b. Manufacturing location(s): Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.

   c. Product Value: Indicate dollar value of product containing local/regional materials; include materials cost only.

   d. Product Component(s) Value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.

3. Refer to Division 1 for additional requirements.

PART 2 - PRODUCTS

2.01 CONCRETE MATERIALS

A. General: Concrete shall conform to Sections 501 and 601 of the Standard Specifications for Highway Construction.

B. General: All concrete, unless otherwise specifically permitted by Architect, shall be transit-mixed in accordance with ASTM C 94.

1. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.

2. In regions where Alkali Silica Reactions (ASR) occur concrete mixes shall be provided with proven performance history to mitigate the problems through the use of:

   a. Low-alkali cement

   b. Non-reactive aggregates

   c. Pozzolans

d. Lithium-based admixtures

C. Portland Cement:

1. Standard Portland Cement: ASTM C 150, Type 1.

2. High Early Strength Portland Cement: ASTM C 150, Type 3.

3. Self-Consolidating Concrete (SCC): A highly flowable, non-segregating concrete that spreads into place, fills formwork, and encapsulates congested reinforcement, which can be placed by means of its own weight, with little or no vibration. The flowability of SCC is measured in terms of spread when using a modified version of the slump test (ASTM C143). The spread (slump flow) of SCC typically ranges from 18 to 32 inches and shall depend on the requirements for the project. The viscosity, as visually observed by the rate at which concrete spreads, shall be controlled when designing the mix to suit the type of application being constructed.

4. Mass Concrete: ASTM C 150, Type 2, or Type 5.

D. Aggregates:

1. In general, comply with ASTM C 33.

2. Fine natural sand, clean, hard, strong, durable, uncoated grains, free from all injurious, deleterious substances passing No. 4 sieve.

3. Coarse gravel or crushed stone, clean, hard, strong, durable, uncoated pieces free from deleterious substances.

a. 1-1/2" (3.8 cm) maximum size aggregate shall conform to gradation for size No. 4 and 3/4" (1.9 cm) aggregate to size No. 67 in Table II of ASTM C 33.

b. When 1-1/2" (3.8 cm) size is used, it shall be proportioned with 3/4" (1.9 cm) aggregate so as to produce gradation conforming to size No. 467 in Table II of ASTM C 33.

4. Where concrete is exposed to view, aggregate shall not contain iron or other staining elements.

5. For exterior exposed surfaces, sidewalks, drives, etc. and parking structures, do not use fine or coarse aggregates containing spalling-causing substances. The amount of chert with a specific gravity less than 2.40 shall be limited to 1.0% of the weight of the coarse aggregate.

E. In regions where Alkali Silica Reactions (ASR) occur concrete mixes shall be provided with proven performance history to mitigate the problems through the use of:

1. Low-alkali cement

2. Non-reactive aggregates

3. Pozzolans

4. Lithium-based admixtures

F. Fly Ash: ASTM C-618 Class "C", the product of only one manufacturer using one source of coal. Maximum loss of ignition shall not exceed three percent (3%). Use Class "F" Fly Ash for mass concrete. Use only when permitted by Engineer.

G. Slag Cement: ASTM C 989, Grade 100, or Grade 120 ground granulated blast-furnace slag.

H. Chemical Admixtures:

1. Admixtures shall not contain more chloride ions than are present in municipal drinking water.

2. Water Reducing Admixtures - conform to ASTM C 494, Type A

   a. "Eucon A+" (Euclid Chemical Co.)

   b. "Polyheed 997" (BASF)

   c. "WRDA with HYCOL" or "WRDA - 82" (W.R. Grace)

   d. "Catexol 1000N" (Axim)

   e. Approved equal

3. Water Reducing, Retarding Admixture - conform to ASTM C 494, Type D

   a. "Eucon Retarder - 75" or "Eucon DS" (Euclid Chemical Co.)

   b. "Pozzolith 100XR" (BASF)

   c. "Daratard - 17" (W.R. Grace)

   d. "Catexol 1000R" (Axim)

   e. Approved equal

4. High Range Water Reducing Admixture (Superplasticizer) - conform to ASTM C 494, Type F or G (retarding), site applied only.

   a. "Eucon 37/1037" or Plastol Series (Euclid Chemical Co.)

   b. "Rheobuild 1000" or "Glenium 3000 NS" (BASF)

   c. "Sikament" (Sika Chemical Corp.)

   d. "Daracem" or "ADVA" Series (W.R. Grace)

   e. "Catexol 1000SP-MN" (Axim)

   f. Approved equal

5. Mid-Range Water Reducing Admixture (MRWR) - conform to ASTM C 494, Type A.

   a. "Eucon MR", "Eucon X15" or "Plastol 341" (Euclid Chemical Co.)

   b. "Polyheed" or "Polyheed 997" (BASF)

   c. "Daracem" or "Mira" Series (W.R. Grace & Co.)

   d. Approved equal

6. Non-Corrosive, Non-Chloride Accelerator - conform to ASTM C 494, Type C or E. The admixture manufacturer shall provide long-term, non-corrosive test data from an independent testing laboratory (of at least 1 year duration) using an acceptable accelerated corrosion test method such as that using electrical potential measures.

   a. "Accelguard 80, 90 or NCA" (Euclid Chemical)

b. "Polarset" (W.R. Grace)

c. "Pozzolith NC 534" or "Pozzutec 20+" (BASF)

d. "Catexol 2000RHE" (Axim)

e. Approved equal

7. Air Entraining Admixture - conform to ASTM C 260

a. "Air-mix" or "Air-mix 200" (Euclid Chemical Co.)

b. "Daravair" or "Darex" Series (W.R. Grace)

c. "MBAE 90" or "Micro-Air" (BASF)

d. "Catexol AE260" (Axim)

e. Approved equal

8. Viscosity Modifying Admixture for use in Self - Consolidating Concrete:

a. "Visctrol", (Euclid Chemical)

b. "V-mar3", (W.R. Grace)

c. "Rheomac VMA", (BASF)

d. "Sika Stabilizer 4", (Sika Corp.)

e. Approved equal

9. Prohibited Admixtures: Calcium chloride, thiocyanates or admixtures containing more than 0.05% chloride ions by weight of admixture are not permitted.

10. Certification: Written conformance to the above-mentioned requirements and the chloride ion content of the admixture is required from the admixture manufacturer.

I. Synthetic Fibers shall be used in concrete mix design in lieu of welded wire fabric. Synthetic fibers shall not replace reinforcing rebar/dowels as depicted on the Construction Details.

1. For concrete sidewalks:

a. Matrix Bi-Blend microfiber – FRC Industries. Application dosage shall be 1.5 pounds per cubic yard.

b. Approved equal

J. Evaporation retardant and finish aid:

1. "Confilm", BASF

2. "Eucobar", Euclid Chemical Co.

3. "Sealtight Evapre", W.R. Meadows, Inc.

4. Approval equal

K. Water: potable

L. Curing and Sealing Compound:

1. Curing and sealing compounds shall be used for interior or exterior applications where concrete is left exposed with no other finish coating or hardener. Compound shall be compatible with paint or striping applications.

2. Liquid type, membrane forming curing and sealing compound complying with ASTM 1315 Type 1, Class A with 25% solids, VOC compliant.

   a. Provide test data from an independent testing laboratory indicating a maximum moisture loss of 0.04 grams per sq. cm. when applied at a coverage rate of 300 sq. ft. per gallon.

   b. Colorless, clear or with fugitive dye or pigment, non-yellowing, U.V. resistant, resin based, not wax based.

      1) "Sealtight Vocomp-25", W.R. Meadows, Inc. (Interior or exterior use - water base)

      2) "Super Aqua Cure VOX", Euclid Chemical

      3) "Super Diamond Clear VOX", Euclid Chemical

      4) Approved equal

3. Provide a second application for sealing and dust- proofing after 30 days, unless noted otherwise.

M. Colored Concrete: Where colored concrete is specified by the Architect, provide integrally colored concrete with pure pigments containing no fillers or artificial adulterants. Colors shall meet standards of ASTM C979. Add to concrete in proportions recommended by manufacturer for type of concrete and installation. Color as selected by Architect.

1. Butterfield Color, Aurora, IL

2. Davis Colors, Beltsville, MD

3. Euclid Chemical Co., Cleveland, OH

4. Lambert Corp., Orlando, FL

5. Approved equal

2.02 MISCELLANEOUS MATERIALS

A. Expansion/Isolation Joints:

1. Premolded expansion joint strips 3/4” thick of premolded resilient, compressible, re-expanding, Non-extruding, bituminous and fiber materials, conforming to ASTM D 994.

2. Plastic joint fillers where called for on drawings or specified shall be foamed polyvinyl chloride plastic premolded joint filler, thickness and width as shown.

   a. "Rodofoam, Grade 327" (Electrovert, Inc.)

   b. Approved equal

3. Joint Filler and Sealants: Polyurethane joint sealant for slab-on-grade control and construction joints required for all exposed concrete including exterior construction.

a. "Sikaflex 2CSL" (Sika)

b. "THC-900", (Tremco), level surfaces

c. "Vulkem 245SL"

d. "THC-901", (Tremco), sloped surfaces

e. "Eucolastic II", (Euclid Chemical)

f. "Sonolastic SL2", (Sonneborn)

g. Approved equal

B. Felt: 15 lb. (6.8kg) asphalt saturated. ASTM D 250.

C. Edge Forms and Screeds: Proper wood or metal screeds, accurately leveled and securely fastened, shall be provided to bring the slabs to the required elevation for the concrete strike-off operation.

D. Moisture Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M 182, Class 2.

E. Moisture Retaining Cover: One of the following, complying with ASTM C 171, for moist-curing concrete:

1. Waterproof Paper

2. Polyethylene sheet not less than 6 mills thick

3. Polyethylene-coated burlap

F. Bonding Compound: Polyvinyl acetate or acrylic base, re-wettable type, for cosmetic nonstructural repairs.

1. "Euco Weld" (Euclid Chemical)

2. "Weldcrete" (Larsen Co.)

G. Epoxy Products: Two component material suitable for use on dry or damp surface, complying with ASTM C 881, for use in all structural concrete repairs.

1. Products for Crack Repair:

a. "Eucopoxy Injection Resin" or "Dural 50"; Euclid

b. "Concresive Standard LVI"; BASF

c. "Product R303", Concrete Injection Resin; "Rescon" Technology Corp.

d. "Sikadur 35 Hi Mod LV"; Sika Chemical Company

e. Approved equal

2. Products for Epoxy Mortar Patches, Interior use:

a. "Concresive 3007" or "Concresive LPL Liquid"; BASF

b. "Euco Epoxy #452" or "Duralcrete System"; Euclid

c. "Product R616, Concrete Bonder" or "Product R404, Epoxy Mortar Resin";

Rescon Technology

d. "Sikadur 21 Lo Mod LV"; Sika Chemical Company

e. "Sikadur 23 Lo Mod Gel"; (overhead, vertical)

f. Approved equal

3. Products for Epoxying Bolts or Reinforcing Steel into Concrete:

a. "Euco 452 Gel" or "Euco 452MV" or "Duralcrete Gel"; Euclid

b. "Concresive 1420 Cartridge System"; BASF

c. "Product R606, Concrete Bonder"; Rescon Technology Corp.

d. "Sikadur 31 Hi-Mod Gel"; (vertical use) Sika Corporation

e. "Sikadur 32 Hi-Mod Gel"; (horizontal use) Sika Corporation

f. Approved equal

H. Polymer Modified Mortars for interior or exterior concrete surface repairs including spalls and patches in non- corrosive environments:

1. "Sika Repair 222 with Sikalatex R"; horizontal repairs; Sika Chemical Corp.

2. "Sika Repair 223 with Sikalatex R"; vertical repairs; Sika Chemical Corp.

3. "Euco Verticoat Supreme" or "Speed Crete Red Line"; Euclid Chemical

4. "Euco Thin Top Supreme" or "Tammspatch II"; Euclid Chemical

5. Approved equal

2.03 MIXES AND DELIVERY

A. Concrete Mix:

1. Ready-mixed concrete shall be subject to the following:

a. Concrete must meet all requirements of the ASTM C 94, ACI 211, ACI 318 Chapter 4 Durability Requirements, and those herein specified for materials, proportioning, mixing and other details of manufacturer, quality and deliver.

b. Submit suitable evidence as to experience, equipment, and capacity of plant to Architect for approval.

B. Mix Proportioning: Furnish ready-mixed concrete in accordance with the following:

Type of Construction	Min. Comp. Strength at 28-day (U.N.O.) PSI	Max Slump In.	Max. Agg. In.	Min Cement Lbs/C.Y.	Air Entrained	Footnotes

Exterior Slab on Grade	4000	2-4	---	587	Yes	(1)(2)

FOOTNOTES:

(1) Air entrained concrete: Use for all exterior slabs, walls, walks, platforms, ramps, steps, all portions of parking ramps, and all other concrete exposed to freezing and thawing. Maximum water/cementitious ratio = 0.45.

(2) Minimum compressive strength at 3 days: 1800 psi. Maximum aggregate size shall not exceed one third of the slab on grade thickness. Coordinate with Contractor as to project schedule. Reduce water/cementitious ratio to 0.40, with MRWR or HRWR, to achieve required water vapor emission rates for installation of finish materials.

C. Additional Mix Requirements

1. Cement content specified above is minimum, except:

   a. If concrete mix test results in accordance with ACI 318 Section 5.3 indicate strength greater than that specified, reduction of specified cement content is allowed.

   b. Should test results indicate strength below that specified, additional cement shall be added without cost to Owner.

2. Fly Ash may be used as a pound for pound replacement of cement up to 20% of the total cementitious content, 25% for footings, except for finished flatwork during winter construction, subject to Architect's approval.

   a. Mixes shall develop sufficient strength to meet contractor's schedule for flatwork finishing and formwork removal. Adjust proportions of fly ash as required.

3. Combination of Fly Ash and Slag, at a 1:1 ratio, may be used as a pound-for-pound replacement of cement as follows:

   a. 30% of the total cementitious content, except for finished flatwork during winter construction.

   b. Mixes shall develop sufficient strength to meet contractor's schedule for flatwork finishing and formwork removal. Adjust proportions of fly ash and slag as required.

4. Air-Entrained Concrete:

   a. Concrete requiring air entrainment shall contain six (6) percent plus or minus one and a half (1.5) percent air by volume, (at end of discharge hose if pumped) for 3/4" dia. aggregate. Conform to ACI 318, Chapter 4. Give proper consideration to the reduction of air content when fly ash is used.

5. Where synthetic or steel fibers are used in slabs, mix designer shall adjust the admixture dosage and/or water content to maintain the specified slump and adjust mix for increase in air content from fibers.

D. Admixture Usage:

1. All concrete must contain the specified water-reducing admixture or water-reducing - retarding admixture and/ or the specified high-range water-reducing admixture (superplasticizer).

2. Specified cement contents shall be increased 10 percent (10%) when no water-reducing admixtures are used.

3. When temperature is at or below 40 degrees F when placing or within next 24 hours, all concrete, less than 8" in thickness, shall contain the specified non-corrosive, non-chloride accelerator.

4. All concrete required to be air entrained shall contain an approved air entraining admixture.

5. All pumped concrete, concrete for industrial slabs, synthetic fiber concrete, architectural concrete, self-consolidating concrete (SCC), concrete for wall pours exceeding 14 feet in height or with high rebar congestion which makes consolidation difficult (bars at 4" on center or less), concrete required to be watertight and concrete with a water/cementitious ratio below 0.41 shall contain the specified site applied high-range water-reducing admixture (Superplasticizer). Mid-range plasticizers may be substituted for high-range when water- cementitious ratios exceed 0.45. Do not use HRWR or MRWR at the batch plant.

6. When high temperatures and/or placing conditions dictate and/or when concrete temperatures exceed 80 degrees F. use a water-reducing- retarding admixture (Type D) in lieu of the water-reducing admixture (Type A).

7. Self-Consolidating Concrete (SCC) shall be used as noted on the plans. The concrete shall contain the specified high-range water-reducing admixture and viscosity-modifying admixture where required. Minimum slump/flow of 20"-30" is required by the successful test placement. The workability, pumpability, finishability, and setting time of the proposed mix design shall be verified with a successful test placement onsite.

8. Admixture Certifications must be submitted with the proposed mix design for review by the Architect.

9. No other admixtures will be permitted.

E. Measuring Materials: Cement, aggregates, water, and admixtures shall be measured and combined strictly in accordance with ASTM Specification C 94.

F. Mixing and Delivery:

1. Ready-mixed concrete shall be mixed and delivered to point designated by means and standards set forth by ASTM Specification C 94.

2. Mixers and agitators may be examined by a representative of Owner for changes in conditions due to accumulation of hardened concrete or mortar or through wear of blades.

3. When concrete is mixed in a truck mixer loaded to its maximum rated capacity, number of revolutions of drums or blades at a mixing speed shall not be less than 70 or more than 100.

4. When a truck mixer or a truck agitator is used for transporting concrete, concrete shall be delivered to site of work, and discharge shall be completed within one and one-half (1-1/2) hours or before drum has revolved a total of 300 revolutions, whichever comes first, after introduction of mixing water to the cement and aggregates, or mixing of cement and aggregates, unless a longer time is specifically authorized by Architect. In hot weather, or under conditions contributing to quick stiffening of concrete, concrete delivery and discharge shall be completed within 45 minutes.

5. Water may be added on the job site in the presence of a testing laboratory representative, to bring the slump to the specified level, but not to exceed 1 gallon per cubic yard and prior to any superplasticizer use. For concrete with w/c less than 0.41 and for concrete exceeding 4,600 PSI strength, concrete supplier's representative and Engineer shall provide approval prior to addition of any water. Mixing time shall be appropriately increased with a minimum of twenty (20) revolutions of the drum. The maximum slump shall not be

exceeded with the addition of water. Concrete with higher slumps will be rejected. Contractor may exceed specified slump only if a superplasticizer is used. Amount of water added on the jobsite shall be recorded on each delivery ticket and concrete test report. All slump tests shall be taken after all water has been added. Water shall not be added to the batch at any later time.

6. Drivers may not wash concrete trucks, or discharge water at any time into pump hoppers used for concrete pumping operation.

2.04 DETECTIBLE WARNING FIELD

A. Detectable warning fields to be Neenah Foundry Detectable Warning Fields (or approved equal), unpainted natural color and field-weathered prior to installation. The color shall be verified with the owner prior to ordering and installation.

PART 3 - EXECUTION

3.01 FIELD QUALITY CONTROL

A. The individuals who sample and test concrete to determine if the concrete is being produced in accordance with this specification, and that slump, air content, temperature and cylinder tests are in conformance with this Specification shall have demonstrated a knowledge and ability to perform the necessary test procedures equivalent to the ACI Minimum Guidelines for Certification of Concrete Field-Testing Technicians, Grade 1. A current certificate shall be presented upon request by Architect.

B. All preparing of specimens and testing shall be performed by an independent laboratory hired by the Owner. Test reports shall be sent to Architect with copies to Contractor and ready mixed concrete producer.

1. This Contractor shall cooperate in taking of test samples and shall make adjustments in mix based on results of tests as directed by Architect.

2. Technician shall have full knowledge of required specifications prior to performance of field tests. Any non-conformance to specification shall be reported by email or fax immediately to Structural Engineer prior to field placement of concrete.

C. Samples of concrete shall be obtained in accordance with ASTM Method C 172 and shall be transported to a place on site where cylinders can be made and stored without being disturbed during first 24 hours.

D. Slump tests shall be performed in accordance with ASTM C143. Make one slump test of the first truck of each mix, each day, one test for each compression test and other tests as often as required thereafter, whenever consistency changes.

1. For parking structures, slump tests shall be performed for each truck load for flatwork.

E. When air-entrained concrete is used, air content tests shall be made from the first truck of each mix, each day and when- ever test cylinders are made, in accordance with ASTM C 173 or ASTM C231. Test more often when required air contents are not achieved.

1. For pumped concrete, air content tests shall be performed at point of discharge in addition to at the truck, once at the beginning of each pour and whenever the pumping orientation is significantly altered. Air contents shall be adjusted at the batching point as required.

2. Air entraining admixture may be added at the jobsite when air content tests too low.

F. Concrete Temperature: Test hourly when air temperature is 40 Degrees F (4 Degrees C) and below, and when 80 Degrees F (27 Degrees C) and above; and each time a set of compression test specimens is made.

G. If measured slump, air content or concrete temperature falls outside limits specified, a check test shall be made immediately on another portion of same sample. In event of a second failure, concrete shall be considered to have failed to meet requirements of specifications and shall not be used in structure. Notify Architect immediately.

H. Cylinders for strength tests shall be made in accordance with ASTM Method C 31. During first 24 hours all laboratory test specimens shall be covered and kept at air temperatures between 60- and 80-degrees F. (16 and 27 C). At the end of 24 hours, specimens shall be carefully transported to testing laboratory where molds shall be removed, and cylinders shall be cured in a moist condition of 65 to 75 degrees F. (18 to 24 C.) until time of test. Strength tests shall be made frequently at direction of Architect. In no case shall any given class of concrete be represented by less than five (5) tests for entire job.

I. A strength test for any class of concrete shall consist of standard cylinders made from a composite sample secured from a single load of concrete in accordance with ASTM C-172.

1. All concrete less than 6000 psi:

a. After 24 hours four cylinders shall be carefully transported to the testing laboratory for moist curing.

b. One laboratory cured cylinder shall be tested at 7 days and two laboratory cured cylinders to be tested at 28 days; retain one cylinder for later testing, if necessary.

J. Strength tests shall be made for each of the following conditions:

1. Each day's pour,

2. Each class of concrete,

3. Each change of supplies or source,

4. Each 150 cubic yards of concrete or fraction thereof

5. Each 5000 square feet of surface area for slabs or walls.

K. To conform to requirements of this Specification, the strength level shall be considered satisfactory so long as the average of all sets of three (3) consecutive strength test results equals or exceeds the specified f'c and no individual strength test result falls below the specified strength f'c by more than 500 psi. Architect shall be notified immediately of nonconformance.

L. A record shall be made by a representative of testing laboratory of delivery ticket number for particular batch of concrete tested and exact location in work at which each load represented by a strength test is deposited.

M. Additional field-cured cylinder tests, in-place cylinders, non-destructive testing, and/or maturity testing may be performed, at Contractor's option and expense, to determine early strength of concrete to facilitate form or shoring removal and shorten construction schedules.

N. If, in the opinion of Architect, concrete of poor quality has been placed, additional tests shall be made as directed. Concrete quality shall be based on visual inspection of the concrete and review and analysis of the cylinder strengths. Additional tests shall be at the expense of Contractor. Tests may be compression tests on cored cylinders obtained by the Testing Laboratory per ASTM C42 or load tests per ACI 318 or as recommended by the Testing Laboratory and directed by the Architect. All testing costs chargeable to Contractor will be obtained from him by means of a credit change order to the Contract.

3.02 PREPARATION

A. Notification:

1. Notify Architect at least 48 hours in advance before pouring.

B. Preparation:

1. Before Placing Concrete:

a. Clean all mixing and transporting equipment.

b. Remove all ice, snow, dirt, chips and other debris from forms or place to receive concrete.

c. Flush and wet down forms thoroughly to close any cracks between boards.

d. Wet down subgrade with as much water as it will absorb readily. Remove standing water.

e. Do not place concrete in dry forms or on dry subgrade.

3.03 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.

2. Place all concrete in accordance with ACI 304, ACI 304.2R and ACI 302 for slabs. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.

3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

4. Crane or dump bucket may be used to transport concrete where concrete cannot be delivered to forms directly from chutes, into forms, wheelbarrows or two (2) wheeled concrete carts.

5. Specified superplasticizers, or approved alternative admixtures, are required in the concrete mix if concrete pumping is used for placement.

6. Delivery carts or buggies and/or pumping equipment shall be kept on temporary runways built over floor systems. Runway supports shall not bear on reinforcing steel or fresh concrete.

7. Concreting operation shall not alter location of reinforcing bars. Extreme care by workmen is required. Do not drag or drop equipment, such as pumping hose on reinforcement.

8. In no case shall concrete be delivered or placed with a free fall exceeding 10 feet for concrete containing superplasticizer, 15 feet for self-consolidating concrete (SCC) or 5 feet for other concrete. Spreading of concrete with hoes and shovels for distance greater than 6'0" from delivery end of chutes, carts or buggies will not be permitted.

9. Consistency of concrete to be such that it will be:

   a. Uniform throughout with mortar clinging to coarse aggregate.

   b. Plastic enough that concrete will work readily into corners and angles of forms and around reinforcement without excessive puddling or spading and without segregation of material or collecting of free water on surface while transporting or placing.

   c. Of sufficient mortar content in mass to fill all voids, prevent harshness or honeycombing in the structure and uniform distribute coarse aggregate.

10. Concrete shall be deposited in such a manner as to secure most thorough consolidation. Vibration with an approved "spud" type internal vibrator with flexible shaft shall be used where possible. Vibrator shall not come in contact with reinforcing or forms. Use and type of vibrators shall conform to ACI 309.

C. Deposit and consolidate concrete for slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

   1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.

   2. Maintain reinforcement in position on chairs during concrete placement.

   3. Screed slab surfaces with a straightedge and strike off to correct elevations.

   4. Slope surfaces uniformly to drains where required.

   5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

D. Concreting In Cold Weather:

   1. Follow ACI 306 and 306.1 for mixing, placing and protection, and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

      a. When temperature is at or below 40 degrees F. (4 C.) when placing or within next 24 hours.

      b. Temperature of all surfaces in contact with newly placed contact shall be a minimum of 37ºF and shall not be more than 10ºF higher than minimum concrete placement temperatures specified in ACI 306.

      c. Provide heated concrete material with temperature of concrete when placed as recommended by ACI guidelines.

      d. Only the specified non-corrosive non-chloride accelerator shall be used. Calcium chloride, thiocyanates or admixtures containing more than 0.05% chloride ions are not permitted.

      e. Do not place on frozen subgrades.

      f. Do not place concrete when the air temperature does not exceed 10F during the day.

      g. Provide adequate housing covering and heating for freshly placed concrete for a minimum period of 72 hours after placing; maintain temperatures above 55°F. Do

not allow carbon dioxide from heating units to contact freshly placed concrete surfaces for a minimum of 48 hours. Vent all heaters outside of any enclosure.

h. All slabs on grade shall be protected from the penetration of frost by use of heaters, insulation, backfill, enclosures or other means. This protection shall exist throughout the entire construction period. Architect may inspect the frost penetration during construction. If frost is within 6 inches of the bottom of any construction in place, the Contractor shall take immediate steps to insulate or heat to prevent further frost penetration.

i. If the protection provided by Contractor is inadequate and frost penetration extends beneath the bottom of the construction, this shall be a basis for rejecting that portion of the work. This rejected work shall be removed and properly replaced at the expense of Contractor.

2. Contractor's Responsibility: Repair or replace, in manner acceptable to Architect, all concrete work damaged due to water, snow, freezing, excessive heating and too rapid drying out.

E. Hot Weather Concreting:

1. Conditions warranting hot weather concreting practices are defined as any combination of high air temperature, low relative humidity and wind velocity tending to impair the quality of fresh or hardened concrete or otherwise result in abnormal properties. Place concrete, cure and protect in compliance with ACI 305, Hot Weather Concreting. Do not place concrete when the air temperature is expected to reach 90° F or greater when placing or within next 24 hours.

2. Temperature of concrete when placed shall not be less than 50 degrees F nor exceed 85 degrees F. Control by:

a. Cooling aggregates.

b. Using cement with maximum temperature of 170 degrees F. (77c).

c. Using cold water or ice.

3. Sprinkle forms, subgrade and reinforcing with cool water prior to placing concrete. Keep buggies, chutes and other equipment shaded.

4. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that the steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.

5. Mixing, Placing and Protection:

a. Keep mixing to minimum requirement which will ensure adequate quality.

b. Do not expose mixers to hot sun.

c. Use concrete promptly.

d. Provide fog spraying operation immediately following placement and prior to final curing.

e. Finish promptly.

f. Protect and cure properly.

g. Do not use retarding agents unless approved by Architect.

h. Maintain concrete temperature not less than 50 degrees F nor more than 90 degrees F for the first three days after placing. Protect from temperatures over 90 degrees F for the next five days.

6. When high temperatures and/or placing conditions dictate, use a water-reducing-retarding admixture (Type D) in lieu of the water-reducing admixture (Type A).

F. Evaporation Retardant/Finishing Aid: During rapid drying conditions (high concrete or ambient temperatures, low humidity, high winds, direct sunlight, etc.) apply a concrete evaporation retardant and finishing aid to minimize plastic cracking. The compound may be required to be applied one or more times during the finishing operation. The initial application is usually made after the strike-off operation.

1. Use is subject to approval of membrane or sealer manufacturer.

3.04 CONCRETE JOINTS

A. Use and location of expansion, contraction, control, and construction joints as approved by Engineer or as shown on drawings. Construct joints true to line with faces perpendicular to surface plane of concrete.

3.05 EXPANSION/ISOLATION JOINTS AND CONTROL JOINTS

A. At joints between slabs on earth and vertical surfaces, including columns, piers and walls, provide premolded joint filler strips. Before placing concrete, set isolation joint material in designated areas. Top of joint material shall be level to 1/4" below finished surface of concrete. Provide adequate means to maintain proper positioning of joint material during concrete placement. The minimum depth of isolation joint material shall be equal to the smaller of the concrete slab thickness with which it comes in contact.

B. Control (contraction) joints shall be provided in all slabs on earth by means of 1/8" to 1/4" wide saw cuts to a depth of 1/4 slab thickness when using conventional saws, 1.25" for early entry cut saws, approximately 12'-0" o/c each way as directed by Architect or as shown on drawings/details. It is preferred that saw-cutting while concrete is "green" to minimize dust and provide for better quality control. Provide dust barriers during cutting operations. Vacuum/clean surfaces following cutting operations to reduce residual concrete dust.

C. Where joint compound is indicated for control and construction joints, install premolded expansion joint filler strips topped with tapered, dressed, oiled wood strip to form groove at least 1" (2.5 cm) deep unless shown otherwise. After concrete has set, per manufacturer's exact specification, remove strip, grind, or sandblast surfaces, prime, and fill groove with specified elastomeric sealant.

1. Required at exposed concrete surfaces including slabs, exterior driveways, garages, and parking areas.

3.06 CONCRETE CURING AND PROTECTION

A. General:

1. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures in conformance with ACI 301 and ACI 308. After placement and prior to finishing of slabs, contractor shall use evaporation retardants, fogging, windscreens, etc. to prevent plastic shrinkage cracking caused by excessive drying of the top surface. For surfaces floated and broomed, place curing compound immediately where allowed.

2. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Keep continuously moist for not less than 24 hours.

3. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days in accordance with ACI procedures. Avoid rapid drying at end of final curing period.

B. Curing Methods: Perform curing of concrete by curing compound, curing, and sealing compound, by moist curing, by moisture-retaining cover curing and by combinations thereof, as herein specified.

1. Provide moisture curing by following methods:

a. Keep concrete surface continuously wet by covering with water.

b. Continuous water-fog spray.

c. Cover concrete surface with specified burlap absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges with 4" lap over adjacent absorptive covers.

2. Provide moisture-cover curing as follows: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width sides and ends lapped at least 3" and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

3. Provide curing compound or curing and sealing compound to slabs as follows:

a. Apply curing compound, per manufacturer's specification, to concrete slabs, including construction joints, after form removal as soon as final finishing operations are complete (within two hours). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Recoat areas subjected to rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period. Cover with moisture retaining cover for 48 hours.

b. Exterior slabs shall have fugitive dye or pigment.

c. Apply at dosage rates per Manufacturer's written recommendation.

3.07 TOLERANCES

A. The construction tolerances for cast-in-place concrete shall meet the requirements of ACI 117 and 347 and the special project tolerance requirements listed below. Where requirements conflict, the more stringent shall govern.

1. Linear and Vertical Lines (When Forms are Stripped):

a. Perimeter slab edges shall be within + or - 3/8" of established lines.

2. Elevations:

a. Top of slab at perimeter edge shall be within + or - 1/4" of established elevations.

3. Slab Thickness: - 1/4" maximum.

3.08 DENSE GRADED BASE

A. Dense Graded Base, required to bring to proper level, are specified in Section 32 11 23.33.

3.09 CONCRETE CURB AND GUTTER

A. Concrete work shall meet the requirements of Division 03.

B. Provide curb and gutter of type and dimensions shown on the drawings, or to match adjacent existing curb and gutter.

C. Trowel and broom the face surface of curb and gutter. Fill any honeycombed or void areas

remaining on the back of curbs with mortar.

D. Concrete curb and gutter shall be placed in accordance with WisDOT Section 601 to the dimensions and shapes shown in the standard detail drawings. Where curb and gutter details are not provided, curb and gutter shape and dimensions shall match existing adjacent curb and gutter.

E. A minimum 4-inch-thick layer of compacted dense graded base shall be provided beneath the full width and a minimum 6 inches behind all curb and gutter. At sections of the curb and gutter to be replaced, the existing base course may be reused provided it conforms to the above requirement and is placed over a stable subgrade. Prior to placement of concrete, the base shall be thoroughly compacted and moistened.

F. All curved curb and gutter shall form smooth curves and shall not be a series of chords. Radius forms shall be used for all curved curb and gutter where the radius of curvature is 100 feet or less.

G. Driveway openings in the curb line shall be staked by CONTRACTOR in the field. The details for concrete gutter sections through a driveway are shown in the standard detail drawings.

H. A 3/4-inch-thick expansion joint filler shall be provided in accordance with Section 415 of the WisDOT Specifications, through the curb and gutter at:

1. The ends of radii on curved sections including intersection radii.

2. At storm sewer inlets (5 feet away from each side).

3. At a maximum interval of 100 feet.

I. Expansion joint filler shall extend through the entire thickness of concrete, be perpendicular to the surface and at right angles to the line of the curb and gutter and be left 1/4-inch below the gutter line.

J. At equally spaced, nominal intervals of not less than 6 feet nor more than 15 feet, with 10 feet typical, a contraction joint shall be tooled to a depth of 1/5 of the total concrete thickness with a 1/4-inch radius jointer. The contraction joint shall be tooled at right angles to the line of the curb and gutter from the top back of curb to the gutter flag.

K. CONTRACTOR shall provide curb and gutter with the following steel reinforcement:

1. Provide two 20-foot No. 4 rebars centered on each utility crossing with 3-inch bottom clearance. One bar shall be positioned 3-inches from the gutter flag and one bar shall be poisoned 3-inches from the back of curb.

2. Provide two 5-foot No. 4 rebars centered on each storm sewer inlet casting having a minimum 4 inches of concrete between the casting and the finished pavement. Rebars shall be positioned 2 inches from the gutter flag. One rebar shall be positioned 2 inches from the top gutter surface. The other rebar shall be positioned 4 inches from the top gutter surface.

L. The location and type of joints in curb and gutter shall match joints in adjacent pavement whenever possible.

3.10 CONCRETE SIDEWALKS, PADS AND DRIVEWAYS

A. Provide concrete pavement having the thickness and reinforcement as shown on the drawings, or to match adjacent existing pavement.

B. Concrete shall have a minimum 28-day compressive strength of 4000 psi with 4% to 7% air entrainment.

C. Tie bars should be placed at all construction joints parallel to traffic and consist of No. 4 reinforcing bars, 24 inches in length and 48 inches on center.

D. 3/4-inch diameter epoxy-coated smooth dowel bars should be at all control joints perpendicular to traffic. Dowel bars shall be 18 inches long and 12" on center.

E. Expansion joints shall be provided where pavement abuts fixed objects, such as buildings and light poles. Control joints shall be in accordance with American Concrete Institute (ACI) recommendations.

F. Concrete sidewalk and driveway shall be placed in accordance with WisDOT Section 602 to the dimensions and thicknesses shown in the standard detail drawings.

G. A minimum 5-inch-thick layer of compacted dense graded base shall be provided beneath all new sidewalks and driveways, unless otherwise noted in the standard details. Where sidewalks and driveways are to be replaced, existing base material may be reused provided it conforms to the above requirement and is placed over a stable subgrade.

H. Sidewalks shall slope toward the roadway at 1/4-inch per foot except the transverse slope of sidewalks at a driveway or alley entrance shall match slope of driveway or alley, but shall not exceed 3/4-inch per foot, unless otherwise noted on the drawings or requested by the engineer.

I. Concrete sidewalk shall be segmented into 5-foot-long rectangular blocks with tooled joints made at right angles to the centerline of the sidewalk. Sidewalk intended as a multi-use path shall be segmented with sawcut joints instead of tooled joints. Tooled edges and joints shall be rounded with an edging tool of 1/4-inch radius. Concrete driveways shall be segmented into uniform rectangular blocks with sawcut joints at a maximum spacing of 12 feet in each direction (or as recommended by ACI). Joint depth must extend at least 1.25" for early entry saws or 1/4 of slab thickness if a conventional saw is used.

J. A 3/4-inch-thick expansion joint filler shall be provided in accordance with Section 415 of the WisDOT Specifications, through the sidewalk. Filler shall be placed at:

1. The ends of radii on curved sections including intersection radii.

2. interfaces of sidewalks and driveways.

3. interfaces of driveways and curbs.

4. interfaces of sidewalks and curbs.

5. interfaces of sidewalks at corners.

6. at box-outs for castings.

7. at 100-foot intervals in sidewalks.

K. Where an existing curb stop box will lie within a proposed sidewalk or driveway apron, CONTRACTOR shall install a frost-proof collar prior to CONTRACTOR pouring concrete.

L. The final floating shall be done with a wooden float. Before the concrete is given the final surface finish, the surface of the walk shall be checked with a ten-foot straightedge, and any areas which show a variation or departure from the testing edge of more than 1/4-inch shall be corrected by adding or removing concrete as necessary while the concrete is still plastic. Before the mortar has set, the surface shall be brushed or lightly broomed. Review finishes and patterns on architectural and landscape plans if applicable.

M. Cure immediately after final finishing.

N. Replace any existing sidewalks, curbs, drives etc. damaged during the construction process.

3.11 CURB RAMPS

A. Curb ramps shall have a maximum slope as indicated in details.

B. Each curb ramp shall be provided with a detectable warning field installed in fresh concrete of all sidewalk and multi- use trails at legal crosswalks, and as shown in the detail drawings. A detectable warning field shall not be installed in asphalt pavements. The detectable warning field shall be installed per manufacturer's recommendations.

3.12 MISCELLANEOUS CONCRETE AND CEMENT WORK

A. Flagpole Base:

1. Construct concrete base and install foundation tube, all in accordance with flagpole manufacturer's instructions, detail drawings and shop drawings.

2. Consult and work in cooperation with Contractor furnishing flagpole.

B. Building sign monument as detailed.

END OF SECTION

SECTION 32 16 13
CONCRETE CURB AND GUTTER

PART 1 - GENERAL

1.01 SCOPE

A. This section includes information common to concrete curb and gutter and applies to all sections in this Division.

B. This work shall consist of constructing concrete curb and gutter, with or without reinforcement, of the dimensions and design as indicated, and placed in one course on the prepared foundation or base, at the locations and to the required lines and grades.

C. The Contractor shall mark the top of the curb where the sanitary sewer and water service cross the curb and gutter. The mark may be made by saw cutting. The depth shall be a minimum of one-sixteenth (1/16”) inch deep. The laterals and services will be located by the City.

D. All work done in the vicinity of any tree located in the terrace shall be completed in accordance with City and/or County specifications for Tree Protection.

1.02 REFERENCE STANDARDS

A. Work under this section depends on applicable provisions from other sections and the plan set in this contract. Examples of related sections include, but are not limited to:

1. Division 03 — Concrete

2. Division 31 — Earthwork

3. 32 13 00 - Concrete Work Outside The Building Envelope

B. City and/or County Standard Specifications for Public Works Construction

PART 2 - EXECUTION

2.01 PREPARATION OF FOUNDATION

A. The Contractor shall be responsible for replacement with 1-1/2” crushed stone, mechanically compacted, of any material necessary to bring the subbase to grade, where the Contractor has undercut the subbase without the direction of the Engineer.

2.02 FORMS

A. Curb and gutter forms shall be of steel construction and conform to the design of the type of curb and gutter being installed. Wooden forms may be used only with the Engineer’s approval on short radius curves and in special cases where accessibility is limited. All forms shall be free of hardened concrete, mud, dirt, and debris, and shall be free of bends and twists which would make their use unacceptable on the project.

B. All forms shall be oiled to the satisfaction of the Engineer before depositing or placing concrete in them.

C. When concrete curb and gutter is constructed on a curve, flexible forms shall be used for all curves having a radius of two hundred (200) linear feet or less.

2.03 PLACING AND FINISHING CONCRETE

A. Wherever directed by the Engineer, driveway gutters shall be built instead of regular curb and gutters.

B. The curb and gutter over ditches shall be installed in twenty (20) foot lengths centered over the ditch. A dummy joint shall be cut at the center of the 20-foot section.

C. Unless otherwise specified, curb and gutter shall be installed in minimum lengths of six (6) feet and maximum lengths of 15 feet.

D. The Contractor shall install a header at the end of each pour. At no time shall the Contractor be allowed to spread excess concrete as a base for the next or any succeeding pour.

E. Wherever different types of curb and gutter are employed, the Contractor shall take care that transitions from one type of curb and gutter to another type are done smoothly without loss of flow line grade or curb head shape.

F. The reconnection of existing drains from adjacent properties to the curb and gutter shall be incidental to concrete curb and gutter.

G. The slope of the curb and gutter shall not exceed 1” in 12” thru handicap accessible ramps.

2.04 JOINTS

A. Full contraction joints shall be a minimum of three (3) inches in depth and shall be uniformly spaced not less than six (6) feet nor more than fifteen (15) feet apart unless otherwise directed by the Engineer.

B. If machine methods are used for forming and finishing curb and gutter the Contractor may saw contraction joints or planes of weakness may be created by the insertion of approved partial depth separator plates having a minimum depth of three (3) inches. The depth of cut and equipment used in sawing shall meet the approval of the Engineer. The sawing shall be done as soon as practicable after the concrete has set sufficiently to preclude raveling during the sawing and before any shrinkage cracking takes place in the concrete. If this method results in random cracking the Contractor shall be required to use the partial depth separator plates.

C. Transverse expansion joints shall be one-half (1/2) inch in width and shall be placed across the curb and gutter perpendicular to the curb line at all radius points of curves having a radius of two hundred (200) feet or less, and on both sides of all inlets installed in curb and gutter. All expansion joints shall extend through the entire thickness of the curb and gutter and shall be perpendicular to the surface. All expansion joints shall be formed by inserting during construction, and leaving in place, the required thickness of joint filler which shall extend through the entire thickness of both curb and gutter.

D. Where curb and gutter and concrete sidewalk or concrete driveways join, an expansion joint one (1) inch in width must be constructed between walks and curb.

E. The joint filler in transverse joints shall be flush with the finished surface of the gutter. The concrete adjacent to these joints shall be finished with a wooden float which is divided through the center and which will permit finishing on both sides of the filler at the same time. Before the curb and gutter is opened to traffic, excess joint filler shall be cut off level with the finished surface.

2.05 REINFORCEMENT

A. Where reinforcement is required, it shall conform to and be placed in accordance with the Standard Detail Drawings, details shown on the plans, as specified in the contract, or as directed by the Engineer.

B. Where directed by the Engineer, the Contractor shall install three (3) one-half (1/2) inch round reinforcing rods fifteen (15) feet long in concrete curbs and gutters which span ditches.

2.06 PROTECTION

A. The curb and gutter must be protected from injury by traffic or other causes, and also from the rays of the sun until completely set.

B. In the event that concrete sidewalk, drives or curb and gutter are placed in cold weather, “Cold Weather Protection” shall be applied in accordance with City and/or County Standards.

2.07 HAND FORMED CURB AND GUTTER

A. The work under this item shall consist of manually forming and pouring curb and gutter at tight locations or where other structures prevent the use of a curb machine, as designated by the Engineer.

END OF SECTION

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SECTION 32 17 23
PAVEMENT MARKINGS

PART 1 - GENERAL

1.01 SCOPE

A. The work under this section consists of providing all work, materials, labor, equipment, and supervision necessary to provide and install pavement markings as provided for in these specifications and on the drawings.

1.02 RELATED WORK

A. Applicable provisions of Division 01 govern work under this Section.

B. Related Work Specified Elsewhere:

1. Section 30 05 00 – Common Work Results For All Exterior Improvements

1.03 SUBMITTALS

A. Submit the manufacturer specifications for each pavement marking. The submittal for each material shall include the following at a minimum:

1. Pavement Marking Material and Manufacturer
2. Color and Batch Number
3. Date Manufactured (Material more than one year old will not be accepted)
4. Manufacturer Name and Address

PART 2 - MATERIALS

2.01 PAVEMENT MARKINGS

A. Furnish paint pavement markings conforming to WisDOT Section 646.2 as specified in the drawings.

B. Paint markings shall be the color yellow for all pavement markings.

PART 3 - EXECUTION

3.01 PAVEMENT MARKINGS

A. Preparing The Pavement Foundation (Sub-Grade):

1. Prepare surface to receive markings and install them in accordance with WisDOT Section 646.3.
2. Apply pavement markings at the locations and to the dimensions and colors as shown on the drawings. If not otherwise specified, marking lines shall be yellow and have a minimum width of 4 inches.

3. Apply pavement markings at a rate per the manufacturers recommended application rate based on the temperature and surface material.

END OF SECTION

SECTION 32 31 19
DECORATIVE METAL FENCES AND GATES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Decorative steel fences.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete.

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.

B. ASTM D523 - Standard Test Method for Specular Gloss; 2014 (Reapproved 2018).

C. ASTM D714 - Standard Test Method for Evaluating Degree of Blistering of Paints; 2002 (Reapproved 2017).

D. ASTM D822/D822M - Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings; 2013 (Reapproved 2018).

E. ASTM D2244 - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates; 2016.

F. ASTM D3359 - Standard Test Methods for Rating Adhesion by Tape Test; 2023.

G. ASTM F2408 - Standard Specification for Ornamental Fences Employing Galvanized Steel Tubular Pickets; 2016 (Reapproved 2023).

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Shop Drawings:
   1. Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, gates, and schedule of components.

D. Manufacturer's Installation Instructions: Indicate installation requirements and maintenance.

E. Manufacturer's Qualification Statement.

F. Installer's Qualification Statement.

G. Manufacturer's Warranty.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum five years documented experience.

B. Installer Qualifications: Experienced with type of construction involved and materials and techniques specified and approved by fence manufacturer.

1.06 DELIVERY, STORAGE AND HANDLING

A. Store materials in a manner to ensure proper ventilation and drainage. Protect against damage, weather, vandalism and theft.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide 20 year manufacturer warranty for structural fence components and material finish.
   1. Structural fence components (i.e. rails, pickets, and posts) shall be warranted within specified limitations, by the manufacturer from date of original purchase. Warranty shall cover any defects in material finish, including cracking, peeling, chipping, blistering or corroding.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Decorative Metal Fences and Gates:
   1. Ameristar Perimeter Security, USA; Montage Industrial, Genesis: www.ameristarperimeter.com/#sle.
   2. Or Approved Equal.

2.02 FENCES

A. Fences: Complete factory-fabricated system of posts and panels, accessories, fittings, and fasteners; finished with electrodeposition coating, and having the following performance characteristics:

B. Electro-Deposition Coating: Multistage pretreatment/wash with zinc phosphate, followed by epoxy primer and acrylic topcoat.
   1. Total Coating Thickness: 2 mils, minimum.
   2. Color: As selected by Architect from manufacturer's standard range.

C. Steel: ASTM A653/A653M; tensile strength 45,000 psi, minimum.
   1. Hot-dip galvanized; ASTM A653/A653M, G60.
   2. 62 percent recycled steel, minimum.

D. Hinges: Finished to match fence components.
   1. Brackets: Square.
   2. Mounting: Center.
   3. Closing: Manual.

E. Latches: Finished to match fence components.
   1. Brackets: Square.
   2. Locking: Magnetic.

2.03 WELDED STEEL FENCE

A. Provide fence meeting requirements for Industrial class as defined by ASTM F2408.

B. Fence Panels: Fusion welded; 6 feet high by 6 feet long.
   1. Panel Style: Three rail with extended pickets.
   2. Attach panels to posts with manufacturer's standard panel brackets.

C. Posts: Steel tube.
   1. Size: 2-1/2 inches square by 12 gauge, 0.109 inch, with manufacturer's standard cap.

D. Rails: Manufacturer's standard, double-wall steel channel 1-3/4 inch square by 12 gauge, 0.1094 inch with prepunched picket holes.
   1. Picket Retaining Rods: 0.125 inch galvanized steel.

E. Pickets: Steel tube.
   1. Spacing: 3-3/4 inch clear.
   2. Size: 1 inch square by 16 gauge, .105 inch.
   3. Style: Square top pickets extend above top rail.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Set fence posts in accordance with the manufacturer recommended spacing.

C. Space gate posts according to the manufacturers' drawings, dependent on standard out-to-out gate leaf dimensions and gate hardware selected.

1. Base type and quantity of gate hinges on the application, weight, height, and number of gate cycles.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch.

B. Maximum Offset From Indicated Position: 1 inch.

3.05 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Layout: Verify that fence installation markings are accurate to design, paying attention to gate locations, underground utilities, and property lines.

C. Gates: Inspect for level, plumb, and alignment.

3.06 CLEANING

A. Leave immediate work area neat at end of work day.

B. Clean jobsite of excess materials; scatter excess material from post hole excavations uniformly away from posts. Remove excess material if required.

C. Clean fence with mild household detergent and clean water rinse well.

D. See Section 01 74 19 - Construction Waste Management and Disposal, for additional requirements.

3.07 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

3.08 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair, or replace damaged products before Date of Substantial Completion.

END OF SECTION

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SECTION 32 90 00
GENERAL LANDSCAPE

PART 1 - GENERAL

1.01 SUMMARY

Furnish all trees, shrubs, and other plant materials, labor equipment, and non plant materials required to complete installation of planting indicated on the landscape drawings and details. Furnish all soil preparation, fertilizer, soil mulching, trees, shrubs, groundcovers, sodding, bed mulching, labor and equipment required to landscape all areas as indicated on the landscape drawings.

Work in this Section includes, installation of trees, shrubs, perennials, annuals, ornamental grasses, sedges, sodding of lawns, installation of mulch materials and mitigation of areas damaged by construction activities performed under this contract.

A. Section Includes

Installation of trees, shrubs, ornamental grasses, sedges, perennials, annuals, turf, seeding, installation of mulch materials and mitigation of areas damaged by construction activities performed under this contract.

B. Owner Furnished Items

None

C. Permits

1. Contractor will be responsible for obtaining all necessary permits required for installation of landscape.
2. Contractor shall know, understand, and comply with all watering restrictions for any temporary or permanent irrigation.
3. Permits may be necessary if restrictions are in effect.

1.02 REFERENCES

A. Refer to Drawings
B. Refer to the Agreement between the Contractor and Owner
C. Refer to Section on soil Preparation
D. Refer to Section on Sodding
E. Refer to Section on Seeding

1.03 DEFINITIONS

A. Subgrade: The final elevation of material supporting additional material above it.
B. Finished Grade: The final elevation of the upper most surface material. (sod shall be top of thatch layer.)

1.04 SUBMITTALS

A. Product Data

Submit product data sheets and photographs when referenced in plans for each of the following items. Submittals must be made prior to commencing any activities.

1. Compost
2. Seed
3. Sod
4. Landscape Boulders
5. Cobble Stone
6. Wood mulch

7. Stone Stairs
8. Stone Bench
9. Formliner Wall
10. Stone Steppers
11. Crusher Fines

B. Samples

Submit physical samples of each of the following materials for approval. All samples shall be submitted in a one quart, clear, plastic bag (Ziploc type) or appropriate container. Submittals must be made prior to commencing any activities. All samples shall be clearly labeled with the following information.

1. Project Name
2. Material name as shown on plans and specifications
3. Supplier or distributor's name
4. Supplier or distributor's product name and/or order number
5. Required samples are as follows

   (a) Shredded hardwood Mulch
   (b) Compost
   (c) Crusher Fines
   (d) Cobble Stone

C. Supplier list

A single list of all material suppliers for plant material, and all related landscape and irrigation (if installed) materials to complete the work in this section and related sections. List must be submitted prior to commencing any activities.

D. Construction Schedule

Prior to beginning installation of the landscape, the Contractor is to submit a project construction schedule to the Owner's Representative for approval. The schedule should include the areas and types of construction to be undertaken and the sequence which will be used to accomplish the completion of the project. Schedule must be submitted prior to commencing any activities. This schedule shall clearly identify proposed timing for seeding, sodding, and planting.

E. Certificates for Inspections of Materials

1. All State, Federal, or other inspection certificates shall be submitted to the Owner's Representative prior to acceptance of the plant material along with other information showing the source or origin.
2. Current grower or nursery certifications indicating that all contractor supplied plant material is healthy, vigorous, and free from insect pests, plant diseases, and injuries

F. Contract Closeout Submittals

1. Operation and Maintenance Manuals
2. At the completion of the work, furnish written maintenance instructions to the Owner's Representative for maintenance and care of the landscaping. Instructions shall include directions for irrigation (if installed), weeding, pruning, fertilization, and spraying, as required for continuance of proper maintenance through a full growing season and dormant period.
3. Contractor shall also furnish an operation manuals for all equipment, provided by the contractor.
4. Guarantee and Warranty
5. At completion of work, furnish written guarantee, and warranty, to the Owner based on the

requirements of this section.

1.05 QUALITY ASSURANCE

A. Reference Standards

1. U.S. Department of Agriculture Rules and Regulations under the Federal Seed Act and equal in quality to standards for Certified Seed.
2. Requirements for measurements, grading, branching, quality, and the balling and burlapping of plants listed in the plant list shall follow the current issue of American Standard for Nursery Stock issued by the American Association of Nurserymen, Inc. (ANSI-Z 60.1-1990)
3. Plants shall equal or exceed the measurements specified in the plant list, which are minimum acceptable sizes. Plants shall be measured before pruning with branches in normal position. Any necessary pruning shall be done at the time of planting.

B. Quality of Materials

1. All materials shall be subject to inspection and approval. The Owner's Representative reserves the right to reject at any time or place, prior to acceptance, the work and all materials which in the Owner's Representative's opinion fails to meet these specification requirements.
2. Inspection is primarily for quality, however, other requirements are not waived even though visual inspection results in approval. Materials may be inspected where growing but inspection at the place of growth shall not preclude the right of rejection at the site. Inspection may be made periodically during installation of materials, at completion, and at the end of guarantee periods by the Owner's Representative. Plants shall have a habit of growth that is normal for the species. They shall be healthy, vigorous, and free from insect pests, plant diseases, and injuries. All plant material shall be inspected stock conforming to all State and Federal Regulations.
3. Plant material shall not exhibit signs of accelerated growth.

C. Vandalism

The Contractor will not be responsible for malicious destruction of plantings after final acceptance of the project. He will, however, be responsible for replacement of vandalized materials stored but not yet installed, and vandalized material prior to final acceptance. All cases of vandalism shall be promptly reported to the Owner. The Contractor shall inform the Owner in writing if additional protection must be installed to protect the landscaping from damage after installation.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping

1. Deliver fertilizer to site in original unopened containers bearing the manufacturer's guaranteed chemical analysis, name, trade name, trademark, and conformance to State law. Notify Owner's Representative of delivery schedule in advance so material may be inspected upon arrival at the job site.
2. Deliver packaged materials in containers showing weight, analysis and name of manufacturer. Protect materials from deterioration during delivery and while stored at the site. Provide copies of delivery receipts for materials to be incorporated into the construction to the Owner's Representative as the deliveries are made. Materials to be accounted for include: fertilizers, soil amendments, peat moss, manure, grass seed, plant tabs, and mulches.
3. Plants shall be containerized with limbs bound, properly wrapped and prepared for shipping in accordance with recognized standard practice. The root system shall be kept moist and plants shall be protected from adverse conditions due to climate and transportation, between the time they are dug and actual planting.

4. Each plant shall be identified by means of a grower's label affixed to the plant. The grower's label shall give the data necessary to indicate conformance to specifications. Use durable waterproof labels with water resistant ink which will remain legible for at least 60 days. Notify the Owner's Representative prior to delivery of plant materials to the site so that a pre-planting inspection may be made or indicate delivery schedule in advance so plant material may be inspected upon arrival at job site, whichever is more appropriate.
5. Do not drop plants. Do not lift plants by the trunk, stems, or foliage. The ball of the plant shall be natural, and the plant shall be handled by the ball at all times. All plants shall be protected at all times from drying out or other injury. Minor broken and damaged roots shall be pruned before planting.

B. Acceptance at Site

1. Remove unacceptable plant material immediately from job site.
2. Major damage shall be cause for rejection.
3. No balled or burlapped plant shall be accepted if the ball is broken or the trunk is loose in the ball, or trees are handled roughly.

C. Storage and Protection

1. Deliver trees and shrubs after preparations for planting have been completed and plant immediately. If planting is delayed more than four (4) hours after delivery, set trees and shrubs in shade, protect from weather and mechanical damage, and keep roots moist by setting balled stock on ground and cover ball with soil, peat moss, or other acceptable mulch material.
2. Keep root balls moist at all times. Do not allow root balls to dry out.
3. Protect all existing and newly planted trees, shrubs, and groundcover within the areas of construction and related excavation as herein specified. Provide suitable barricades and/or fences as required.

1.07 PROJECT/SITE CONDITIONS

A. The Contractor must examine the subgrade upon which work is to be performed, verify subgrade elevations, observe the conditions under which work is to be performed, verify suitability of the soil and notify the Owner's Representative in writing of unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Owner's Representative. Commencement of work shall mean acceptance of the site conditions.

B. Existing Conditions

1. The site will be provided to the contractor within ±0.1 foot of finish grades.
2. Utilities
   Determine location of underground utilities and perform work in a manner which will avoid possible damage. Do not permit heavy equipment such as trucks, rollers, or bulldozers to damage utilities. Hand excavate when called for to minimize the possibility of damage to underground utilities. Maintain grade stakes set by others until removal is mutually agreed upon by all parties concerned. Any damage to utilities that may result in spite of protective measures must be completely corrected and repaired by the Contractor at no additional cost to the Owner.

1.08 SEQUENCING & SCHEDULING

A. Planting Schedule

Schedule each type of landscape work required during the normal season for such work in the area of the site. Establish dates for each type of work and establish a completion date. Correlate work with specified maintenance periods to provide maintenance until accepted by the Owner. Do not depart from the accepted schedule, except with written authorization.

Submit request to the Owner's Representative for changes in the planting schedule. When delays in the planting schedule are unavoidable, include documentation of the reason for delay. Plant trees and shrubs during normal season for such work in the location of the project.

B. Coordination With Lawns

Plant trees and shrubs after final grades are established and prior to planting of lawns, unless otherwise acceptable to the Owner's Representative. If planting of trees and shrubs occurs after lawn work, protect lawn areas and promptly repair damage to lawns resulting from planting operations.

1.09 WARRANTY & GUARANTY

A. Guarantee trees, shrubs, groundcovers and all plant material for a period of two years from the date of substantial completion against defects not resulting from neglect of Owner, or abuse and damage by others.
B. For a period of one year after acceptance of work, at no additional cost to the Owner, the Contractor is to replace any plants that are dead, or that are in unhealthy or unsightly condition, or have lost their natural shape due to dead branches or excessive pruning. Inadequate maintenance by the Owner shall not be cause for replacement. All replacement planting is to be done no later than the succeeding season.
C. Replacement plants shall be of the same variety and size or larger as originally specified in the plant list. Plants shall be planted as originally specified. All areas damaged by planting or replacement operations shall be fully restored to their original condition as specified. Remove all dead or defective plant material from the site immediately.
D. A one year warranty shall also apply to the plants replaced at the first warranty walk-through (which occurs one year after substantial completion).

1.10 MAINTENANCE

A. Begin interim maintenance period immediately after planting of landscape materials, and after planting of lawn areas, and continue interim maintenance until landscape work is deemed substantially complete and accepted by the Owner or Owner's Representative.
B. The maintenance period, as specified on the bid form, will commence when all areas have received substantial completion. Large or phased projects may require adjustments to this date. This can be negotiated with the owner and Owner's Representative after installation has begun.
C. Meet with the Owner prior to final acceptance, and prior to the termination of the maintenance period, to go over maintenance requirements of the project. Note that information conveyed to the owner shall be consistent with the maintenance instructions provided by the contractor, as part of the contract close out submittals.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Mulch

1. Shredded hardwood Mulch
2. Compost
3. Crusher Fines
4. Cobble Stone

B. Stakes and Guys

1. Stakes - 2' metal t-posts, 6' wood posts
2. Guys - 14 gauge galvanized steel wire
3. Nylon straps - 1 1/2", with metal grommet ends.
4. 1/2" White, PVC pipe, 24" lengths.

C. Tree Wrapping

Clark's Tree Wrap, 4" wide, designed to prevent winter bark injury. Secure with flexible grafting ties.

D. Trees, Shrubs, Ornamental Grasses, Sedges, and Flowers

1. Provide nursery grown trees, shrubs, ornamental grasses, Sedges, and flowers except as otherwise indicated, grown in a recognized nursery in accordance with good horticultural practice, with healthy root systems developed by transplanting or root pruning. Provide only healthy vigorous stock, free of diseases, insects, eggs, larvae, and defects such as knots, sunscald, injuries, abrasions, or disfigurement. Plants grown in Hardiness Zones 2,3,4, and 5 only, will be accepted. Hardiness Zones are defined in U.S. Department of Agriculture publications. Grower's certificates may be required when doubt exists as to the origin of the plant material.
2. Provide trees, shrubs, ornamental grasses, sedges, and flowers true to name and variety established by the American Joint Committee on Horticultural Nomenclature "Standardized Plant Names", Second Edition, 1942.
3. Provide trees, shrubs, ornamental grasses, sedges, and flowers of the size shown or specified in the plant list and in accordance with the dimensional relationship requirements of ANSI Z60.1 for the kind and type of plant material required. Plant material of larger than specified size may be used, in which case the sizes of the root balls will be increased proportionately.
4. Label each tree and shrub with a securely attached waterproof tag bearing legible designation of botanical and common name and size.
5. Where formal arrangements or consecutive order of plants are shown, select stock for uniform height and spread, and label with numbers (if necessary) to assure symmetry in planting.
6. Provide plant material complying with the recommendations and requirements of ANSI Z60.1 "Standard For Nursery Stock" and as further specified.

E. Deciduous Trees

1. Provide trees of the height and caliper listed or shown.
2. Where shade trees are required, provide single stem trees with straight trunk and intact leader, free of branches to a point.
3. Where small trees of upright or spreading type are required, provide trees with single stem, branched or pruned naturally according to species and type, and with the relationship of caliper and branching recommended by ANSI Z60.1, unless otherwise shown.
4. Where shown as "bush form" provide trees with 3 or more main stems starting close to the ground in the manner of a shrub.
5. Where shown as a "clump form" provide trees with 3 or more stem starting from the ground.
6. Provide balled and burlapped deciduous trees unless noted as container plants. Balled and burlapped plants shall be dug with firm, natural balls of earth of the diameter specified or larger, to encompass the fibrous and feeding root system necessary for full recovery of the plant. No balled or burlapped plant shall be accepted if the ball is broken or the trunk is loose in the ball.

F. Deciduous Shrubs and Groundcovers

1. Provide deciduous shrubs with not less than the minimum number of canes required by ANSI Z60.1 for the type and height of shrub specified.
2. Plants furnished in containers shall have been grown in pots, cans, or baskets long enough to have sufficient roots to hold earth together intact after removal from container, without being root bound.

G. Coniferous and Broadleaf Evergreens

1. Provide evergreens of the size shown. Dimension indicates minimum spread for spreading and semi-spreading type evergreens and height for all other types such as globe, dwarf, cone, pyramidal, broad- up-right, and columnar.
2. Provide evergreens with well balanced form complying with requirements for other size relationships to the primary dimension shown.
3. Trees shall exhibit consistent growth periods, and shall not exhibit signs of accelerated growth.
4. Provide balled and burlapped evergreen trees unless otherwise noted as container or collected stock.
5. Foliage shall have a good intense color.
6. Trees shall contain a central dominant leader with evenly spaced branches. Plants containing multiple central leaders will be rejected.

H. Requirements for Balled and Burlapped Stock:

1. Where shown or specified to be balled and burlapped, provide trees and shrubs dug with a firm, natural ball of earth in which they were grown.
2. Provide ball size of not less than the diameter and depth recommended by ANSI Z60.1 for the type and size of tree or shrub required. Increase ball size or modify ratio of depth to diameter as required to encompass the fibrous and feeding root system necessary for full recovery of trees or shrubs subject to unusual or atypical conditions of growth, soil conditions, or horticultural practice.
3. Wrap and tie earth ball as recommended by ANSI Z60.1 for the size of balls required. Drum-lace balls with a diameter of thirty inches (30") or greater.

I. Requirements for Container Grown Stock

1. Where specified as acceptable, provide healthy, vigorous well rooted shrubs or ornamental grasses established in the container in which they are sold.
2. No bare rooted or recently containerized stock will be accepted.
3. Established container stock is defined as a tree or shrub transplanted into a container and grown in the container for a length of time sufficient to develop new fibrous roots so that the root mass will retain it's shape and hold together when removed from the container.
4. Use rigid container which will hold ball shape and protect root mass during shipment.
5. Provide trees and shrubs established in containers of not less than the minimum sizes recommended by ANSI Z60.1 for the kind, type, and size of trees and shrubs required.
6. Perennials, sedges, and ornamental grasses provided in containers shall have well developed root masses (without being root bound) and should display an appropriate amount of foliage for the time of year in which they are being planted. Cutting back of perennials and grasses for fall planting is acceptable assuming a portion of the plant is visible and cutting does not damage the growing portions of the plant.

PART 3 - EXECUTION

3.01 EXAMINATION

Contractor shall inspect the site with the owner and/or Owner’s Representative prior to beginning any activities on site. The contractor shall provide a written report of any discrepancies that would interfere with their scope of work, or would delay progress on the project.

3.02 INSTALLATION/APPLICATION/ERECTION

A. Proceed with and complete the landscape work as rapidly as portions of the site become available, working within the seasonal limitations for each kind of landscape work required.
B. Cooperate with any other Contractors and trades which may be working in and adjacent to the landscape work areas. Examine drawings which show the development of the entire site and become familiar with the scope of all work required.
C. Final Plant Locations

1. Stake location of individual trees, for approval by Owner's Representative, prior to planting or excavating.
2. If a new tree or shrub relocation is necessary due to interference with underground piping or wiring, the Contractor shall notify the Owner's Representative and receive approval of a new location.
3. The Owner's Representative must approve the precise location of all plants prior to pit excavation and installation.
4. Make minor adjustments as requested by the Owner's Representative, or as necessary to avoid conflicts with sprinkler line locations.

D. Excavation For Planting

1. Where rubble fill is encountered, notify Owner's Representative and prepare planting pits properly by removal of rubble or other acceptable methods.
2. If rock, underground construction work, or other obstructions are encountered in excavation for planting of trees or shrubs, notify the Owner's Representative. If necessary, new locations may be selected by the Owner's Representative.
3. If subsoil conditions indicate the retention of water in planting areas, as shown by seepage or other evidence indication the presence of underground water, notify the Owner's Representative before backfilling.
4. Tree pits shall be dug with flat bottoms and vertical sides. Tree pits shall be dug with radius equal the diameter of the root ball. All tree pits shall have a minimum depth to accommodate root ball.
5. The contractor will be responsible for demonstrating to the Owner's Representative's that planting pits will have adequate drainage. This shall be performed by digging sample holes throughout the site and filling them with water. Holes must drain with in twenty four hours to be acceptable. Pits that do not drain shall be provided with twelve inch (12") diameter X thirty six inch (36") deep auger holes (one per tree pit) to be filled with 1 1/2" gravel. A change order will be issued if the Owner's Representative determines drain holes shall be installed.

E. Setting and Backfilling

1. Set container grown stock, excavate as specified for balled and burlapped stock except container width and depth shall govern. Pit shall be at least twice as wide as the container.
2. Set tree ball, plumb and in the center of pit or trench with top of ball 2", minimum, above adjacent landscape grades. Remove burlap from sides and tops of balls, but do not remove from under balls. Remove platforms, if any, before setting. Do not use stock if ball is cracked, or broken before or during planting operation. When setting place additional backfill around base and sides of ball, and work each layer to settle backfill and eliminate voids and air pockets. When excavation is approximately 2/3 full, water thoroughly before placing remainder of backfill. Repeat watering until no more is absorbed. Water again after placing final layer of backfill.
3. No burlap shall be pulled out from under balls.
4. A minimum of three-quarters of the wire basket and surplus nylon or binding shall be completely removed, taking care not to damage the root ball. Any roots which are bruised or broken shall be pruned at the time of planting.
5. After planting, the Contractor shall water each plant regularly until final acceptance.
6. Set container grown stock as specified for balled and burlapped stock, except cut cans on 2 sides with a metal cutter, and remove bottoms of wooden boxes before setting. Carefully remove cans and sides of wooden boxes after partial backfilling so as not to damage root balls.
7. For plantings in non-turf areas, provide berm around the edge of excavations to form shallow saucer to collect water and to hold mulch.

F. Mulching

1. Fine grade all planting beds to be mulched allowing for full depth of specified mulch.
2. Place specified mulch evenly over all areas at depth indicated on plans.
3. Rake and feather finish grade of mulch level and 1/2" below adjacent edger surfaces.
4. Make sure mulch is at full depth at adjacent walks and paved surfaces and that mulch doesn't protrude above these surfaces.
5. Mulch a 36" diameter ring around all trees in turf areas with specified depth of wood mulch, after irrigation areas have been watered in.
6. All trees and shrubs in native areas are to have a mulch ring equal to the diameter of the planting pit. Mulch shall be a uniform three inches in depth. Do not remove saucer (or berm) around plants in native areas when mulching.

G. Pruning

1. Prune, thin out, and shape trees and shrubs in accordance with standard horticultural practice. Prune trees to retain required height and spread.
2. Do not cut tree leaders, and remove only injured or dead branches from flowering trees, if any.
3. Prune shrubs to retain their natural character and shape, and to accomplish their use in the landscape design.
4. Required shrub sizes are the size after pruning.
5. Remove and replace excessively pruned or deformed stock resulting from improper pruning.

H. Guying and Staking

1. Removal of all guying and staking should be performed prior to the final (warranty) inspection and the cost shall be included as part of the installation of the work.
2. Deciduous guying system
   Pound stakes into undisturbed soil beyond the planting pit so that stake is secure (2' deep minimum). Secure wire through metal grommets on nylon strap and wrap above first branch or at mid-point of tree. Secure guy wire to stake so that it is taut but allows some movement and so that no sharp projection of wire are extending from post. Adjust tension on wire if needed. Flag guy wire with 1/2" PVC pipe for visibility.
3. Conifer guying system
   Pound stakes into undisturbed soil beyond the planting pit sot that stake is secure (2' deep min.), angling away from planting pit and so that top is flush with finish grade. Secure wire through metal grommets on canvas strap and wrap at mid point of tree. Secure guy wire to stake so that it is taut but not overly tight and so that no sharp projection of wire are extending from post. Adjust tension on wire if needed. Flag guy wire with 1/2" PVC for visibility.

3.03 FIELD QUALITY CONTROL

A. When all the landscape work is completed, the Owner’s Representative, shall upon seven (7) calendar days advance notice, make an inspection of the landscape work to determine if the work is complete. The Owner’s Representative shall prepare a punch list of items improperly installed, inadequately sized or otherwise deficient based on the findings of his inspection. The punch list shall be completed not more than seven (7) working days after the field inspection. When the Contractor has remedied all deficiencies and completed all items on the punch list, the Contractor shall request another inspection by the Owner’s Representative to determine whether the deficiencies have been adequately corrected. Once the punch list items have been corrected and re-inspected, the Owner’s Representative shall issue a written certificate to the Owner who will then respond to the Contractor in writing formally accepting the work and beginning the warranty and guarantee period.

B. Additional landscape inspections shall be conducted upon request by the Owner's Representative, to determine the condition of the work at the completion of the guarantee period.
C. The required maintenance instructions shall be forwarded to the Owner's Representative prior to the final acceptance to inform the Owner of any maintenance responsibilities that would be required for the project.

3.04 ADJUSTING AND CLEANING

A. During landscape work, store materials and equipment where directed.
B. Keep pavements clean and work areas in an orderly condition.
C. Protect landscape work from loss, damage, and deterioration during storage, installation, and maintenance periods.
D. Protect from unauthorized persons (trespassers), as well as from operations by other Contractors and tradesmen and landscape operations.
E. At the time of the final inspection of the work and before the issuance of Final Acceptance, all paved areas shall be thoroughly cleaned by the Contractor by sweeping, and washing. All construction equipment and excess materials shall have been removed and any debris or rubbish shall have been removed from the site.

END OF SECTION

SECTION 32 90 12
LANDSCAPE MAINTENANCE

PART 1 - GENERAL

1.01 SUMMARY

A. This section provides guidance on long term maintenance and care for landscape areas.

B. The contractor will accomplish irrigation management (if included), fertilization, pruning, weeding, pesticide applications, bed cultivation, mowing, edging and litter removal in landscape areas. Clean up of walkways, trails, and open space with in the project limits shall also be included.

C. Unit Prices
The contractor will furnish all materials, equipment, supplies and personnel necessary to perform the services contained herein.

D. Project Communication
1. The Contractor shall have one person designated as the Contract Manager. That person shall be available for a meeting and/or walk through of the property, at least once each month, upon the request of The Owner.
2. It is expected that the Contractor will advise The Owner or it's representatives, of all actions the Contractor reasonably believes are prudent, necessary, or beneficial, to improve and maintain the appearance and health of the landscape at the property.

1.02 QUALITY ASSURANCE:

A. All work shall be performed to the highest standards of horticultural excellence and shall be in accordance with accepted standard practices. All work shall be performed in accordance with all applicable laws, codes, ordinances and regulations of all local, state and federal government agencies, and it will be the responsibility of the contractor to obtain at its cost all necessary certificates, permits and licenses required by such agencies.

B. Contractor shall maintain a weekly landscape maintenance log, indicating services performed. Submit reports weekly to the Owner's Representative using e-mail.

C. Contractor shall assume all responsibility for plant material or turf which is damaged or stressed in any way as a result of poor maintenance. Contractor will assume all cost associated with replacement of damaged plant material.

PART 2 - PRODUCTS

Refer to construction documents or record drawings for material specifications.

PART 3 - EXECUTION

3.01 TREE MAINTENANCE

A. Pruning
1. The following will be used as guidelines for pruning maintenance on trees. Pruning will be accomplished in the early spring and late winter. Pruning in this agreement will be initiated for the following.

(a) Plants too close to a building, walkway, fence, power line or any tree limiting visibility shall be pruned appropriately to reduce the obstructing branches.
(b) Removal of diseased or insect infested or weak growth portions of the tree.
(c) Pruning to remove storm damage or other mechanical injury. Pruning to shape or remove excess unwanted growth or winter die back.
(d) Prune trees to select and develop permanent scaffold branches that are smaller in diameter than the trunk or 48 inches and radial orientation so as not to overlay one another; to eliminate diseased or damaged growth; to eliminate narrow V-shaped branch forks that lack strength; to reduce toppling and wind damage by thinning out crowns; to maintain growth within space limitations; to maintain a natural appearance; to

balance crown with roots. Under no circumstances will stripping of lower branches ("raising up") of young trees be permitted. Lower branches shall be retained in a "tipped back" or pinched condition with as much foliage as possible to promote caliper trunk growth (tapered trunk). Lower branches can be cut flush with the trunk only after the tree is able to stand erect without staking or other support.

(e) The primary pruning of deciduous trees shall be done during the dormant season. Damaged trees or those that constitute health or safety hazards shall be pruned at any time of the year as required.

(f) Coniferous trees shall be thinned out and shaped when necessary to prevent wind and storm damage.

2. Pruning for general clean-up of trees is required in the late winter or early spring prior to the activation of the irrigation system.
3. Pruning specified as "normal maintenance" will include trees or tree limbs, that are up to twelve (12) feet tall using conventional pruning tools.
4. The contractor must immediately contact the Owner concerning trees which may present a threat to the public safety. The Owner should be contacted so that the threat may be eliminated and a price negotiated for the repair.
5. The contractor is not responsible to repair or replace any plant materials damaged or killed by vandalism or extreme conditions beyond the contractor's control, as reasonably determined by the Owner's Representative. Plant materials damaged or killed as the result of a contractor's actions or neglect will be replaced in kind at the contractor's expense.
6. All pruning will be performed by qualified personnel may require supervision by an arborist if requested by the Owner.
   (a) Final cuts on branch removal must be made just outside the flare of the branch base, not flush with the tree trunk.
   (b) Limbs removed from a tree must be cut near a crotch. Bracing, cabling and lip bolting may be required in special instances.
   (c) Damaged, dead or dying trees and shrubs will be removed immediately upon being observed by maintenance staff.
   (d) Damaged trees or those which constitute health or safety hazards will be pruned or removed at any time of the year as required.
   (e) Cost to remove and dispose of dead plant material is the sole responsibility of the contractor.

B. Care of wounds
1. The contractor must take prompt action to repair any injuries that occur to plants and immediately initiate the repair. Repairs will be completed only by competent employees trained and familiar with repair techniques.
2. Storm or severe wind injury must be addressed immediately after any storm to determine the extent of any plant related injuries.
3. Bark may also be destroyed by animals, sunscald, mowers or vandalism. The contractor shall treat bark injuries according to the current industry standards.
4. Tree paint shall not be used to treat wounds.

C. Tree Wrap
1. Deciduous trees with up to a 4" trunk diameter for newer, less established thin bark deciduous trees will be wrapped each fall no later than November 1st. Tree wrap shall be removed no later than May 15th. Or as required by weather, location of tree, or other environmental factors.
2. Wrap from the ground to the first major branch. Secure by jute. Do not use electrical tape. Wrap trees between November 15 and April 15.
3. Remove wrap during the growing season, from April 15 to November 15.
4. Use a commercially available tree wrap.

D. Fertilization
1. Fertilize trees with 18-7-10 formulation, slow release fertilizer. Apply 6 oz./100 s.f. Apply once in spring. Apply by spreading fertilizer evenly around the ball of the tree. Apply from

the trunk out to the drip line.

2. If trees exhibit iron chlorosis, provide foliar fertilization with chelated iron. Cost of foliar fertilization is a part of this contract. Avoid contact with all stainable surfaces including concrete sidewalks, pavers, planter walls, rock mulch, project signage, and lights. Obtain written authorization of Owner's Representative prior to fertilization.

E. Insecticide application:
1. All pine trees shall receive one application of approved insecticide to treat for and reduce the infestation of the Ips beetle.
2. Any spray application shall be timed properly in order to minimize damage and maximize chemical effectiveness.
3. Foliar insecticide spray shall be of a material approved by the Owner.

F. Mulching
Mulched tree rings will be well maintained. Additional mulch may be added to these only after the approval of the Owner, using the prices submitted in the supplementary bid schedule.

3.02 PLANTING BED CARE

A. Pruning
1. Prune shrubs, ground covers, and flowers to maintain a natural appearance. There are no plantings in which shearing is intended.
2. Cut back ornamental grasses to ¼ of their mature height in the spring during March. Remove and dispose of cuttings.
3. Cut back herbaceous perennials to the ground in March. Remove and dispose of cuttings.
4. Prune all dead, diseased, and dying branches.
5. Prune long uncharacteristic branches that detract from the shrub's overall form. Prune branches adjacent to bare spots to encourage full shrub growth.
6. Prune flowering shrubs within two weeks after flowering has ended (to prevent pruning of future flower buds).
7. Prune ground covers to maintain a neat, well kept appearance and to prevent ground covers from climbing shrubs.
8. Cut back taller growing herbaceous perennials when they become rangy in appearance.
9. Pinch back dead flower heads on a weekly basis to promote greater flowering.
10. Cut back bulbs after foliage has turned a 50-75% yellow and begun to fall off.
11. Prune shrubs too close to a building, walkway, fence, power line or any tree limiting visibility to reduce the obstructing branches.
12. Removal of diseased or insect infested or weak growth portions of the shrub.
13. Pruning to remove storm damage or other mechanical injury. Pruning to shape or remove excess unwanted growth or winter die back.
14. Shearing
    (a) Never, unless a hazardous situation exists, and only after the approval by the Owner, will the contractor shear a shrub.
    (b) Shearing is not a practice that helps maintain a native image and design.
    (c) This shall exclude clump grasses, as shearing is the recommended method of pruning in the spring prior to re-growth.
15. Renewal pruning: overgrown shrubs usually are leggy, lacking foliage in the lower one-half to two-thirds due to shading from the top or non-flowering. This pruning activity should be accomplished during the dormant season pruning. Height reduction may be accomplished at the same time. This activity is accomplished by removing the oldest and weakest canes at or near ground line. All branches can be cut to the ground or one-third of the oldest branches can be removed every year.
16. Thinning shrubs: the contractor will remove the oldest canes each winter (canes over four (4) seasons old). Insignificant small shoots will be removed to the base or to the crotch of the plant.
17. Heading back: the contractor will head back isolated shoots which may cause the plants to

become out of balance. Prune to the base of the branch or the crotch.

B. Fertilization
In April, fertilize all planting beds with 18-7-10 formulation, slow release fertilizer at the rate of 6 oz/1,000 sq. ft. Use a broadcast method for application of fertilizer.

C. Bulb and Perennial Maintenance
In the spring, divide perennials when they become too crowded. Relocate divisions to bare spots. Do not overly thin.

D. Mulching
Shrub bed areas will be well maintained at a depth of three inches. Additional mulch may be added to these only after the approval of the Owner, using the prices submitted in the bid schedule.

E. Weeding
1. Weeds represent the greatest threat to successful establishment of areas. Therefore, a vigorous, high level of weed control is necessary to maintain an attractive, healthy landscape.
2. Spot control weeds bi-weekly using chemical and/or mechanical means. Do not spray in windy weather. Use extra caution in application of chemicals to prevent overspray onto desired plant material.
3. Mechanical means are the preferred methods for removal of weeds.
4. Planting beds shall be inspected bi-weekly for weeds.
5. If spraying weeds, dead material shall be removed form planting beds immediately so as not to create tumbleweeds or unnecessary debris.

3.03 MANICURED TURF CARE

A. Mowing and Edging
1. Mowing shall occur on Thursdays with Friday being the alternate date in the event of rain.
2. The frequency of mowing may vary in the spring and fall due to seasonal weather conditions and growth rate of turf.
3. In the event the season is longer or shorter or if inclement weather prohibits safe operation of equipment on the regularly schedule mowing day, the mowing schedule shall be adjusted according to current conditions.
4. All turf areas shall be mowed weekly during the growing season to a height of no shorter than 2 to 3 inches. All turf areas shall be cut to the same height and shall be cross cut when feasible.
5. The mower blades or reels shall be sharpened and maintained to provide a smooth, even cut without tearing. The result shall be a uniform, level cut without ridges or depressions.
6. Do not use heavy mower in areas prone to rutting.
7. Do not leave tire marks on sidewalk.
8. Mowing shall be performed so that no more than one-third (1/3) of the grass blade is removed during each mowing.
9. Edging of walks and curbs will be performed every other mowing during the growing season using a steel bladed edger. All debris shall be removed from street and walks.
10. Chemically edge and manually trim around trees monthly ensuring that turf grows no closer than eighteen inches (18") to the tree trunk– a three foot diameter ring around each tree. This bare area should be a uniform circle using the trunk as a center point. This area should be mulched with the specified wood bark mulch.
11. Mow and Trim around trees (keeping mulch in saucers and beds), walls, fences, etc.,
12. All turf areas inaccessible to mowing equipment will be trimmed weekly as needed to maintain a neat, well-groomed appearance, (fence row areas, street lights, transformers, phone pedestals, etc.)
13. Trim growth around all lamp posts, drains and other permanent structures located on the turf on a weekly basis during the growing season.
14. Protect trees and shrubs from damage caused by trim lines. Replace all plant material killed

or seriously injured by trim lines. Replace with plants of equal or better size and quality. Replace at no cost to Owner. Seriously injured is defined as when 30% or greater of the cambium layer of the trunk circumference has been removed by trim lines or when shrubs have been seriously deformed (in the opinion of the Owner's Representative).

15. Protect fences, buildings, and other structures from damage caused by mowers or trim lines.
16. Clippings on paved areas or crusher fine trails shall either be vacuumed or blown off and removed from walks and streets.
17. Excessive grass clippings should be removed as necessary.
18. Trash shall be picked up before each mowing.
19. If mowers cause damage or notice damage or over watering the area should be marked with marker flags or flagging tape. Observations should be reported to the site superintendant who will implement the necessary action.

B. Fertilization
1. In April, the turf shall be fertilized with quality slow release granular product intended to fertilize and control broad leaf weeds ("weed and feed"). Unless otherwise directed or the contractor has other suggestions use a 4-1-1 ratio of nitrogen to phosphorus to potassium with 25% to 50% slow release nitrogen from sulfur coated urea (SCU) at a rate of one pound of nitrogen per 1,000 square feet.
2. In late September, the turf shall be fertilized to stimulate root growth using a granular urea fertilizer (46-0-0) at a rate of two pounds of nitrogen per 1,000 square feet, Unless otherwise directed or the contractor has other suggestions.
3. Fertilizer shall immediately be removed from concrete walls, curbs and streets to prevent staining and runoff into waterways.
4. Fertilizer should be watered in thoroughly after application.
5. Iron will not be acceptable in the fertilizer mixture.
6. Additional fertilization may be required to coincide with events, client expectations, or health of plants. The maintenance contractor shall discuss this with the Owner or Property Manager in advance to receive authorization for additional costs incurred with this application.

C. Insect disease control - turf
Insect and disease treatment shall be by application of necessary insecticides and fungicides as conditions of turf requires. The cost of this will be covered under an extra to the agreement with price agreed upon by Contractor and The Owner prior to initiating the work.

D. Aeration
1. The contractor shall aerate one time per year in September to improve water penetration, before the second fertilization. Contractor shall use only a hollow core tine aerator that pulls a 3" plug.
2. Prior to aeration the contractor shall tag all sprinkler heads and valve boxes to prevent damage. Plugs shall be left on the turf to assist in breaking down thatch.
3. Irrigation system (if included) will be checked out for damage by contractor immediately after aeration and any damage due to aeration will be the responsibility of the contractor to repair at his expense.
4. Damage to any other fixture will be repaired at contractor's expense.

E. Weed Control
1. Refer to the Woodland Restoration notes within the plans for proper woodland weed control and planting times.
2. Where specified by the Owner, a complete broadleaf herbicide treatment shall be applied during the second week in May. The Owner shall provide a diagram for areas to be treated.
3. Throughout the growing season weed control of native areas shall be performed using a spot treatment method.
4. Herbicide shall be applied by a licensed applicator or under the direct supervision of a licensed applicator. Any collateral damage as a result of spraying will be the responsibility of the contractor.
5. Do not spray in windy weather. Use extra caution in application of chemicals to prevent

overspray onto desired plant material.

6. The contractor shall use Chaparral™ brand herbicide (manufactured by Dow AgroScience, LLC) for treatment in native areas. Apply and mix in accordance with the manufacturer's product specifications.
7. Chemical treatment of weeds within four feet of fence lines, occupied residential lots, or planting beds shall be performed using a hand sprayer or back pack sprayer to minimize the risk of overspray.

F. Overseeding and Re-Seeding
1. When directed by the Owner re-seeding areas shall be accomplished using a broadcast method.
2. The cost of seeding shall be determined using the costs identified in the agreement.
3. Hydromulching shall be required only when specifically requested by the Owner. Hydromulch and tackifier shall be applied at a rate equal to 2,000 lbs. per acre.
4. Reseeding and overseeding shall occur the third week in June.
5. Refer to construction plans or record drawings for seeding rates and mixtures.

3.04 NOXIOUS WEED CONTROL

Remove noxious weeds, as defined by the State of Wisconsin from the area within five feet of the perimeters of the landscaped areas by spraying with an approved broadleaf herbicide by May 15th and October 1 with spot application as required. Cost for spot applications, shall be done on a time and material basis per the contract documents. Refer to Woodland Restoration Notes in the plan set for proper weed control in woodland areas.

3.05 REPLACEMENTS

A. The contractor shall note in maintenance logs all removed plant material. Replacements shall occur as directed by the Owner's Representative.

B. If replacement becomes necessary, conform with material and installation standards (including a one year warranty) established in the original project specifications.

C. Replace plant material with size equal to that of the plant material being replaced unless otherwise directed by the Owner's Representative.

D. All replacements shall be affixed with an inconspicuous tag, to be removed after the warranty has expired. This tag shall indicate the date the plant material was installed.

3.06 DISEASE/INSECT CONTROL

A. Inspect all landscape areas weekly during growing season for signs of insect or disease infestation.

B. Apply seasonal applications as necessary to protect plant material.

C. Spot treat areas as needed to maintain healthy growing plant material. Spot treatment is included in the scope of this contract.

D. Do not apply airborne insecticides or pesticides when unprotected people or animals may be affected.

E. Protect all trees, shrubs, and ground covers from over spray that is detrimental to the health of ornamental plant material.

F. Notify Owner's Representative if extensive spraying is required. Pricing for maintenance work should include the costs of typical pesticide applications.

3.07 TRASH REMOVAL AND CLEAN UP

A. Clean all areas weekly to provide a neat, well groomed site. Pick up all trash and debris, sweep walks, replace mulch in beds, reinstall weed barrier wherever it has risen above the mulch or pulled loose at the edges. Pinch back dead flower heads.

B. Adjust cleanup to match seasonal needs.

C. All landscaped areas will be policed for loose trash and debris on a weekly basis during the entire year, especially before each mowing.

D. Trash cans shall be emptied weekly

E. Provide weekly, complete policing and litter pickup to remove paper, glass, trash, undesirable materials, animal and bird droppings, siltation and other accumulated debris within the hard surfaces and landscape areas to be maintained, including but not limited to: walkways, between and around planted areas, drains, catch basins, and pond edges.

F. Litter pickup shall be completed as early in the day as possible, but in no case later than 10:00 A.M.

G. Contractor shall be responsible for off-site removal of all trash, litter and accumulated debris to an approved disposal site weekly.

H. Fallen leaves will be cleaned up twice per year from all turf and bed areas - once between April 1st and may 1st and the second time between November 15th and December 1st. In turf, the leaves can be mowed and left in place.

3.08 SWEEP/WASHING

A. Check paved areas bi-weekly for cracks, crevices and deterioration. Report any problems to Owner's Representative immediately. Walkways, trails, hard surface areas, shall be cleaned, including but not limited to: the removal of all foreign objects from surfaces, such as gum, grease, paint, graffiti, broken glass, etc. Methods of sweeping of designed areas can incorporate one or all of the following
   1. Power pack blowers
   2. Vacuums
   3. Brooms
   4. Push power blowers

B. In the event the Contractor elects to use power equipment to complete such operations, Contractor shall be subject to locate ordinances regarding noise levels. Further, any schedule of such operations may be modified by the Owner's Representative in order to insure that the public is not unduly impacted by the noise created by such equipment.

C. Sweep all walkway and hard surface areas once per week following mowing.

3.09 GRAFFITI

A. Eradication and control shall include all surfaces throughout the site, including
   1. Walkways and hard surfaces
   2. Site furniture
   3. Boulders
   4. Retaining walls
   5. Monumentation
   6. Signage
   7. Lighting

B. All materials and processes used in graffiti eradication shall be non-injurious to surfaces and adjacent property, and approved by Owner's Representative.

C. Appropriate surface preparation shall be made on painted surfaces. Paint applied shall be the exact shade of color as existing paint, unless otherwise specifically approved by the Owner's Representative.

D. Contractor shall use special care and attention when removing graffiti from treated or sealed surfaces. Such surfaces shall not be painted. Contractor shall use materials, and methods of application approved by Manufacturer and Owner's Representative.

E. Visually inspect all areas weekly. Remove graffiti the same day it is visually noted.

F. Graffiti is not part of the base maintenance contract and will be paid for on an hourly basis as approved by the Owner at the stipulated unit price.

3.10 PEST CONTROL

Contractor shall report to the Owner the existence of any pests damaging, interfering with, or with the potential to damage or interfere with, the landscaping or irrigation system (if included), including but not limited to, prairie dogs, voles, and porcupines. Contractor shall remove pests as directed by the Owner, using only subcontractors approved by the Owner. This removal cost is "extra" and contractor will be paid using a supplementary pricing for pest removal equipment and labor. Removal may, include relocation of the pest.

3.11 STANDARD WINTER SERVICES

A. All landscaped areas should be patrolled weekly for loose trash and debris.

B. Remove leaves resulting from fall leaf drop only in areas having a heavy concentration of leaves that may cause damage to turf or to other landscape materials.

C. The contractor shall be responsible to monitor all landscape and plants to determine if there is need for winter watering, tree wrapping to prevent sunscald, special pruning due to storm damage, etc. A semi-monthly soil moisture assessment, on the contractor's report, shall be provided to the Owner.

D. When hand watering, use a water wand to break the water force. All trees and shrubs shall be winter watered using a needle type root feeder as required between irrigation system winterization and spring startup.

E. The irrigation system (if included) shall not be used for winter watering.

END OF SECTION

SECTION 32 91 10
SOIL PREPARATION

PART 1 - GENERAL

1.01 SUMMARY
Work in this Section includes, ripping, fertilizing, soil conditioning, and fine grading as shown on plans and details, included on construction drawings, as under this contract.

1.02 SUBMITTALS
Submit product data sheet for compost.

1.03 DELIVERY, STORAGE AND HANDLING
Comply with related sections

1.04 PROJECT/SITE CONDITIONS

A. Do not perform work when climate and existing site conditions will not provide satisfactory results.
B. Vehicular accessibility on site shall be as directed by the Owner's Representative. Repair damage to prepared ground and surface caused by vehicular movement during work under this section to original condition at no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Compost

1. A totally organic product that has been aerobically and naturally processed without the addition of coarse wood chips, in such a manner as to maintain a consistent temperature of 140 degrees Fahrenheit or greater for a period of time sufficient to create the following characteristics, measured by dry weight.

   (a) Moisture content of 30%-35%
   (b) Organic matter to nitrogen ratio: 25:1 to 30:1.
   (c) pH: 6.0 to 8.0 pH.
   (d) Salts: maximum of 10 mmhos/cm.
   (e) Less than 1% soil, dirt or sand.
   (f) Maximum particle size of ½ inch diameter.
   (g) Eradication of all harmful weed seeds, pathogens and bacteria.
   (h) A non-offensive, earth smell.

2. Acceptable materials are as follows.

   (a) A-1 Organics - Premium 3
   (b) Front Range Materials (Arvada, Colorado, 303-425-9992)– Ground Compost (Item #18-126)
   (c) Certified "Class I" compost product

B. Plant Mix Backfill for Trees

1. Plant mix shall be used to backfill around all tree plantings as indicated on the drawings. The plant mix shall consist of equal parts of

   (a) Topsoil
   (b) Compost
   (c) Excavated soil
   (d) Myke Pro AN1 (www.usemyke.com) at the manufacturer's recommended rate for the tree's size/caliper

Caliper / Height	Myke Pro Cups Each
1.5 in (40 mm)	2
2.0 in (50 mm)	3
2.5 in (65 mm)	4
3.0 in (75 mm)	5
4.0 in (100 mm)	6
4.5 in (115 mm)	7.5
4'	1.75
5'	2
6'	3
7'	3.5
8'	4
10'	5
12'	6
14'	7.5

2. The ingredients shall be thoroughly mixed to produce a mix as integrated as possible.

C. Bluegrass sod and irrigated bluegrass seed area amendments

Thoroughly mix the following amendments tilled to a depth of six inches.
Specified Compost 6.0 c.y. per 1,000 s.f.

D. Naturalized seed areas

1. All seed areas shall receive “Biosol 6-1-3” organic fertilizer at the time of seeding at a rate of 1,000 pounds per acre. If soils test identify more or less fertilizer required, the contractor will be expected to submit a change order to adjust the contract price for a credit or overage.
2. Specified Compost 6.0 c.y. per 1,000 s.f.
3. Thoroughly mix till the areas to a depth of six inches.

E. Planting Bed Amendments

Thoroughly mix the following amendments tilled to a depth of six inches. No additional backfill amendments are required around shrubs if amending the entire bed area.
Specified Compost 6.0 c.y. per 1,000 s.f.
Diammonium Phosphate 5.0 lbs. per 1,000 s.f.
Pre-emergent Weed Controller use manufacturer’s specified rate

2.02 SOURCE QUALITY CONTROL

A. Verification of Performance

1. Compost and other soil amendments are typically identified by a rate of cubic yards per 1000 s.f. In order to accurately determine if amendments are applied at the correct rate, the following chart is supplied. This chart is intended to verify the cubic yards by allowing a method for measuring the depth of the material spread uniformly across the surface of the planting area, with no exposed soil, prior to mixing the amendments with the existing soils.

2. This method will be used during inspections to verify that adequate amendments are incorporated into the soil.

c.y./1000 s.f.	Depth (inches)
6 c.y./1000 s.f.	1 inch
5.0 c.y./1000 s.f.	1 ½ inches

3. An inspection of soil preparation will be performed by the Owner's Representative before areas will be released for planting. The inspection shall consist taking a soil sample to determine
   (a) Proper tilling of the soil. Soil will be judged on how easily a soil probe can be inserted into the ground.
   (b) Proper depth of tilling, and homogeneity of the soil. The soil sample will be judged on uniformity of the soil profile in the top six to eight inches.
   (c) A visual inspection for adequate compost will be conducted. An area that has similar soil structures, that has not received compost will be used as the basis of comparison. Should a disagreement exist, multiple soil samples will be sent to an independent testing laboratory to determine the amount of organic matter present. The cost of this testing will be absorbed by the Owner's Representative.

PART 3 - EXECUTION

3.01 EXAMINATION

A. General

1. Verify that existing site conditions are as specified and indicated before beginning work under this Section.
2. Unknown soil conditions may exist on site. This specification is intended to be a standard specification for Soil Preparation for bid purposes only. The contractor shall be responsible for creating a suitable soil medium that ensures healthy plant growth. Immediately following rough grading operations, the contractor shall take multiple soil samples of the site to identify any chemical, structural, or other soil borne issues that would make the soil counter productive to healthy plant growth. This analysis shall include recommendations for additional organic matter required for the soil. Should amendments or additional work be required to make these soils more conducive to healthy plant growth, the contractors shall submit a change order for the modification 30 days prior to start of landscape installation for Owner's Approval. The change order request shall clearly detail any additional work or amendments necessary for those unacceptable soils.

B. Grades

Inspect to verify rough grading is within +0.1 foot of grades indicated and specified.

C. Damaged Earth

Inspect to verify that earth rendered unfit to receive planting due to concrete, water, mortar, limewater or any other contaminant dumped on it has been removed and replaced with clean earth from a source approved by the Owner's Representative.

D. Cleanliness

Inspect to verify that site is clean of all trash and debris.

E. Equipment

Inspect to verify other trades have removed all equipment and staging areas from areas of work.

F. Unsatisfactory Conditions

Report in writing to General Contractor with copy to Owner.

G. Acceptance

Beginning of installation means acceptance of existing conditions by installer.

3.02 PREPARATION

A. Protection

1. Locate sewer, water, irrigation, gas, electric, phone and other pipelines or conduits and equipment prior to commencing work.
2. Be responsible for proper repair to landscape, utilities, walls, pavements and other site improvements damaged by operations under this section.

B. Weed Control

1. Remove weeds by applying herbicide 1 week before soil preparation and as needed, but no sooner than 3 months before beginning work.
2. If the area to be developed is infested with noxious or invasive weeds, a chemical application will be required, at a rate recommended on the chemical's product label.
3. The contractor shall remove all weeds prior to tilling or spreading any soil amendments. All dead plant material shall be removed from the site and not tilled into the soil.
4. Refer to Woodland Restoration Notes in the plans for proper weed control in woodland areas.

C. Surface Grade

Remove weeds, debris, clods and rocks larger than ½". Dispose of accumulated debris at direction of owner or Owner's Representative.

D. Runoff

Take measures and furnish equipment and labor necessary to control the flow, drainage, and accumulation of water. Insure that all water will run off the grades.

E. Erosion Control

1. Take measures and furnish equipment and labor necessary to control and prevent soil erosion, blowing soil and accumulation of wind-deposited material on the site throughout duration of work.
2. No areas of the site may remain unprotected for more than 30 days, or as directed by the storm water management plan and civil engineer's specifications.
3. The contractor shall assume maintenance and management responsibilities for erosion control in an area upon commencement of activities in that area. Erosion control practices must be compliant with the GESC plan, and any Storm Water Management Plans/Programs in place.
4. The contractor will be expected to begin repair to damaged erosion control devices, siltation, wash outs, etc. with in twenty four hours of a storm event or upon notification by the Owner's Representative.

3.03 INSTALLATION

A. Soil Amendment

Evenly distribute soil amendments, conditioners, and fertilizer, and first application of fertilizer in landscaped areas at the rates outlined in Part 2.01 of this Section.

B. Mixing

After applying soil conditioner, fertilizers, and compost thoroughly till area to depth of 6" minimum by tilling, plowing, harrowing, or disking until soil is well pulverized and thoroughly mixed.

C. Fine Grading in all Landscape Areas:

1. Do fine grading for areas prior to planting.
2. For ground surface areas surrounding buildings to be landscaped, maintain required positive drainage away from buildings.
3. Establish finish grades to within 0.04 foot of grades indicated.
4. Fine grading must be inspected and approved by Owner's Representative.
5. Any damage caused by inclement weather, to finish grades before inspection, will be

repaired by the contractor, prior to acceptance by Owner's Representative.

6. Sodded areas - Allow 1" for sod.

D. Noxious weeds or parts thereof shall not be present in the surface grade prior to landscaping.

E. Prior to acceptance of grades, hand rake to smooth, even surface free of debris, clods, rocks, and vegetable matter greater than ½".

3.04 FIELD QUALITY CONTROL

A. Inspection

1. Provide notice to Owner's Representative requesting inspection at least seven (7) calendar days prior to anticipated date of completion.
2. The following required inspections will be conducted to ensure proper preparation of soil, prior to planting.

   (a) During, or after, the first cultivation
   (b) After the application of specified soil amendments.
   (c) During, or after, the second cultivation
   (d) After the final grades have been established

B. Deficiencies

Owner's Representative will specify deficiencies to Contractor who shall make satisfactory adjustments and shall again notify Owner's Representative for final inspection.

3.05 CLEANING

Remove debris and excess materials from site. Clean out drainage inlet structures. Clean paved and finished surfaces soiled as a result of work under this Section, in accordance with direction given by Owner's Representative.

3.06 PROTECTION

Provide and install barriers as required and as directed by Owner's Representative to protect completed areas against damage from pedestrian and vehicular traffic until acceptance by Owner. Contractor is not responsible for malicious destruction caused by Others.

END OF SECTION

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SECTION 32 91 13.50
STORMWATER BIOINFILTRATION

PART 1 - GENERAL

1.01 SCOPE

A. The work under this section shall consist of providing all work, materials, labor, equipment, and supervision necessary to construct Stormwater Bioinfiltration Devices. The work under this section does not include providing all work, materials, labor, equipment, and supervision necessary to install plantings for the Stormwater Bioinfiltration Device.

1.02 RELATED WORK

A. Applicable provisions of Division 1 govern work under this Section.

1. Section 32 05 00 – Common Work Results For All Exterior Improvements
2. Section 31 25 00 – Erosion Control
3. Section 33 40 00 – Storm Drainage Utilities
4. Section 32 93 00 – Exterior Plants

1.03 REFERENCE STANDARDS

A.	WISDOT PAL	Wisconsin Erosion Control Product Acceptability List (PAL)
B.	WISDOT SSHSC Construction	Standard Specifications for Highway and Structure
C.	WI DNR Infiltration	Standard 1002 – Site Evaluation for Stormwater
D.	WI DNR	Standard 1004 – Bioretention for Infiltration
E.	WI DNR	S100 – Specification for Compost

1.04 SUBMITTALS

A. Provide product data for the following materials:

1. Geotextile Fabrics
2. Pipe
3. Aggregates
4. Sand
5. Compost
6. Engineered Soil

7. Erosion Mat

B. Provide product data for engineered soil blend components: Sand and Compost in compliance with WI DNR Standard 1004 – Bioretention for Infiltration for review and approval by DFD Project Representative.

1.05 QUALITY ASSURANCE

A. Contractor shall submit, in writing to the City Project Representative, a certification from compost supplier that any compost used on the project is in compliance with the requirements outlined in WDNR Specifications S100.

B. Contractor shall submit, in writing to the City Project Representative, a certification from engineered soil supplier that any engineered soil used on the project is in compliance with the requirements outlined in WI DNR Standard 1004 Bioretention for Infiltration.

PART 2 - MATERIALS

2.01 GEOTEXTILE FABRIC

A. Pipe Sock: The openings of the geotextile fabric shall be small enough to prevent sand particles from entering the underdrain pipe. The fabric shall meet the requirements of the WisDOT SSSHC Section 612.2.8.

B. Filter Fabric: The fabric shall meet the requirements of the WisDOT SSSHC Section 645.2.4, Geotextile Fabric Type DF, Schedule B.

2.02 PIPE

A. Underdrain Pipe

1. Pipe shall be corrugated HDPE or PVC, Schedule 40.

2. Pipe shall have a minimum diameter of 6-inches.

3. Pipe shall have perforations.

4. The pipe shall be covered with a filter sock if the storage layer is sand. The filter sock shall conform to the material requirement for Geotextile Fabric.

B. Cleanout Pipe: The cleanout pipe shall be rigid, non-perforated PVC covered with a watertight cap.

2.03 AGGREGATES

A. All aggregates used in the construction of Stormwater Bioinfiltration devices shall be double washed and free of organic material and fines.

B. Storage Layer Aggregate: The aggregate used for the storage layer shall meet the following gradation requirements:

Sieve Size	Percent Passing by Weight
2-inch	100

1 ½-inch		90-100
1-inch	20-55	
3/4 –inch		0-15
3/8 – inch	0-5	

C. Clear Stone Bedding: Washed angular stone or pea gravel shall be used to cover the underdrain pipe. Washed angular stone or pea gravel, graded from 3/8” to 1/4”.

2.04 SAND

A. The preferred sand component consists of mostly SiO_2, but sand consisting of dolomite or calcium may be used.

B. Manufactured sand or stone dust is not allowed.

C. The sand shall be washed and drained to remove clay and silt particles prior to mixing.

D. Sand shall meet one of the following gradation requirements:

1. USDA Coarse Sand (0.02-0.04 inches)
2. ASTM C33 (Fine Aggregate Concrete Sand)
3. WisDOT SSHSC Section 501.2.5.3.4 (Fine Aggregate Sand)

2.05 COMPOST

A. Compost shall meet the requirements of WI DNR Specification S100 – Compost.

2.06 ENGINEERED SOIL

A. Engineered Soil shall comply with WI DNR Standard 1004. Engineered Soil hall be a blend of Sand and Compost

B. Engineered Soil shall consist of a mixture of 70 to 85% Sand and 15 to 30% Compost. The percentages are based on volume.

C. Engineered soil mix shall be free of rocks, stumps, roots, brush, or other material over 1 inch in diameter. No other materials shall be mixed with the planting soil that may be harmful to plant growth or prove a hindrance to planting or maintenance.

D. Engineered soil mix shall have a pH between 5.5 and 8.0.

E. Do not fertilize.

F. Thoroughly blend engineered soil off-site before delivering to site and installing.

G. Engineered soil shall be delivered to the site and stored on plastic sheeting.

H. The moisture content shall be low enough to prevent clumping and compaction during placement.

2.07 EROSION MAT

A. Erosion Mat shall comply with the PAL for Urban, Class 1, Type B as defined by Standard Specifications for Highway and Structure Construction and the PAL. Erosion mat shall be American Excelsior-Curlex Net-Free, Erosion Control Blanket-S32BD, Western Excelsior-Excel SS-2 All Natural, Ero-Guard EG-25 (NN), Erosion Tech ETRS2BN or approved equal.

PART 3 - EXECUTION

3.01 PROTECTION MEASURES

A. Pre-Installation Meeting: Prior to the installation of the Stormwater Bioinfiltration Device, the A/E, the City Project Representative, and the Contractor shall conduct a pre-installation meeting.

B. Stabilization: Construction of the Stormwater Bioinfiltration Device shall not begin until after the contributing drainage area has been stabilized with vegetation and/or hardscapes. Construction site runoff from disturbed areas shall not be allowed to enter the Stormwater Bioinfiltration Device.

C. Weather

1. Construction shall be suspended during periods of rainfall or snowmelt. Construction shall remain suspended of ponded water is present or if residual soil moisture contributes significantly to the potential for soil smearing, clumping, or other forms of compaction.

2. Delays resultant from weather shall not serve as a basis for a Change Order.

D. Compaction Avoidance

1. Compaction and smearing of the soils beneath the floor and side slopes of the Stormwater Bioinfiltration area, and compaction of the soils used for backfilling shall be minimized.

2. During construction, the area dedicated to the Stormwater Bioinfiltration Device shall be cordoned off to prevent access by heavy equipment.

3. Acceptable equipment for constructing the Stormwater Bioinfiltration Device includes excavation hoes, light equipment with turf type tires, marsh equipment, or wide-track loaders.

E. Compaction Remediation

1. If compaction occurs at the base of the Stormwater Bioinfiltration Device, the soil shall be refractured to a depth of at least 24-inches.

2. If smearing occurs, the smeared areas shall be corrected by raking or rototilling.

3. Compaction and smearing remediation shall be conducted by the Contractor at no additional costs to the Owner.

F. Field Infiltration Testing

1. Immediately after rough grading of Stormwater Bioinfiltration Devices, provide field infiltration testing conducted by a third-party testing agency to verify

infiltration rates for all Stormwater Bioinfiltration Devices. Field tests shall be conducted using a Double-Ring Infiltrometer per ASTM D3385. Calculate infiltration rates in accordance with Wisconsin Department of Natural Resources (WDNR) Site Evaluation for Stormwater Infiltration, Standard 1002. Frequency of testing shall be 1 test per 5000 square feet of surface area of the Stormwater Infiltration Device measured at the design high water level and at least one test per device. Furnish a report of the test results to Architect/Engineer.

3.02 TEMPORARY EROSION AND SEDIMENT CONTROLS

A. The Contractor shall install temporary erosion and sediment controls prior to beginning construction of the Stormwater Bioinfiltration Device. The temporary erosion and sediment controls shall divert stormwater runoff away from the Stormwater Bioinfiltration Device until it is completed.

3.03 Excavation

A. Excavation equipment shall work from the sides of the Stormwater Bioinfiltration Device to excavate the area to the depths and dimensions as shown on the Drawings. Excavation equipment shall have adequate reach so that they do not need to be located within the footprint of the Stormwater Bioinfiltration Device to excavate it.

B. Any accidental compaction shall be remediated as prescribed above.

3.04 STORAGE LAYER

A. Place the Storage Layer Aggregate to the depth as indicated in the Drawings.

3.05 UNDERDRAIN PIPE

A. Install underdrain pipe at the invert elevations indicated in the Drawings. Pipe shall be installed with a minimum slope of 0.005 ft/ft. Pipe joints shall be made in accordance with the manufacturer’s recommendation. Standard pipe fittings shall be used.

B. Install cleanouts where shown. Cleanouts shall be installed with a watertight cap located flush with the surface of the Stormwater Bioinfiltration Device.

C. Connect pipe to drainage structure as indicated in the Drawings.

3.06 CLEAR STONE BEDDING

A. Clear Stone Bedding above the underdrain pipe to a thickness indicated in the Drawings.

B. Clear Stone Bedding layer shall be installed between the Storage Layer Aggregate and the Engineered Soil.

3.07 FILTER FABRIC

A. Install filter fabric around engineered soil extents including sides and bottom to separate from Engineered Soil and Storage Layer as shown in the Construction Drawings, overlapping edges a minimum of 6”.

3.08 ENGINEERED SOIL

A. Verify moisture condition of Engineered Soil is low enough to prevent clumping and compaction during placement. Engineered Soil shall not be placed unless it meets these conditions.

B. Place Engineered Soil in lifts not to exceed 12 inches in depth until the desired elevation of the Stormwater Bioinfiltration Device is achieved.

C. Re-examine the surface within 48 to 72 hours following placement of Engineered Soil. Place additional Engineered Soil until desired elevation of the Stormwater Bioinfiltration Device is achieved at no additional costs to the Owner.

D. Steps may be taken to induce mild settling of the Engineered Soil as needed to prepare a stable planting medium and to stabilize the ponding depth.

E. Vibrating plate style compactors shall not be used to induce settling.

F. No equipment travel on or across placed Engineered Soil is permitted.

G. Install silt fence or other means of erosion control around the perimeter of the engineered soil to protect from siltation or contamination from adjacent landscape or paved surfaces and construction activities. Leave erosion control in place until site landscape establishment and construction is complete.

3.09 EROSION MAT

A. Install Erosion Mat on top of surface prior to installation of vegetation.

END OF SECTION

SECTION 32 92 19
SEEDING

PART 1 - GENERAL

1.01 SUMMARY

A. The contractor shall supply all material and labor necessary for seeding of grasses, seed mix, and wetland seeding, in areas shown on plans.

B. The contractor will be expected to produce a lush stand of grasses by the end of the second full growing season.

1.02 REFERENCES

A. Reference Standards: Comply with U.S. Department of Agriculture Rules and Regulations under Federal Seed Act and be equal in quality to standards for Certified Seed.

B. Refer to General Landscape Section

C. Refer to Landscape Maintenance Section

D. Refer to Fine Grading and Soil Preparation Section.

1.03 SYSTEM DESCRIPTION

A. Performance Requirements
   1. Seeded Areas
      This includes all areas within the limits of work that are recently seeded, and do not receive supplemental watering. Contractor should monitor these areas on a regular basis for the presence of weeds. Areas will require individual attention and separate maintenance schedules, thus the contractor is responsible for developing and sustaining a weed-free, lush stand of dryland grasses. Chemical, mechanical, or manual methods should be implemented to prevent the spread of weeds. Mowing is the preferred method to help establish newly seeded areas. Contractor will be expected to re-seed or over-seed areas as bare spots develop. Bare spots should not exceed 12 inches square by the end of the first full growing season.
   2. Bidders shall assume that all seed areas will require an initial seeding and a second overseeding. The second seeding may be drill seeded or overseeded depending on the amount of coverage achieved in the first attempt at seeding.
   3. Seeding shall generally be completed in spring and fall. It may be necessary to alter the production schedule or installation practices to ensure the majority of the seed is installed at the optimal time. For instance it may be necessary to eradicate weeds and seed prior to installing irrigation. Then install irrigation and repair the limited areas where lines were installed.
   4. If seeding occurred in the early fall/late summer, it may be required to perform the second seeding during the following landscape season. The second seeding shall not be a condition of initial acceptance, but will be required when reviewing the performance of areas as part of the warranty and final inspections.
   5. Refer to Woodland Restoration notes in the plan drawings for proper woodland seed mix and procedures.

1.04 SUBMITTALS

Refer to submittals in General Landscape Section.

1.05 PROJECT/SITE CONDITIONS

A. Existing Conditions
   Vehicular accessibility on site shall be as directed by Owner's representative. Repair damage to prepared ground and surfaces caused by vehicular movement during work under this section to original condition at no additional cost to Owner.

B. Environmental Conditions
Do not drill or sow seed during windy weather or when ground is frozen or otherwise untillable.

1.06 WARRANTY

At completion of work, furnish written warranty to Owner based upon requirements as specified.

1.07 MAINTENANCE

A. The interim maintenance period shall begin immediately after each area is seeded and continue until substantial completion of entire project. Final acceptance of seeded areas will not be given until Owner's representative is satisfied with germination and a full stand of grass is in a vigorous growing condition, with consistency and completion of coverage. During this time, be responsible for watering, mowing, spraying, weeding fertilizing and all related work as necessary to ensure that seeded areas are in a vigorous growing condition. Provide all supervision, labor, material and equipment to maintain seeded areas.

B. Constant, proactive maintenance of seed areas and regular reviews of the performance are critical to the successful establishment of seeded areas. The contractor is expected to monitor the seeded areas before and after the contract maintenance period and keep these as weed free as reasonably possible. This means throughout the construction period the contractor may need to apply herbicides as frequently as a weekly basis on areas infested with weeds (or undesirable species) or areas where aggressive weeds are observed. Mowing may be a suitable method for weed management as long as it is done so as not to prevent the spread of weed seeds. The contractor will be expected to include a weed management program as part of their bid.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Seed Mix –See Plans

B. Seeding Rate – Per provider

C. Fertilizer

Biosol All-Purpose Natural Organic Fertilizer 6-1-3 mixture; www.biosolusa.com

D. Hydromulch (turf seed only)

Sterilized, wood fiber made from mechanically defibrated whole wood chips, colored green with a non-toxic dye. Cellulose or paper mulches will not be accepted.

E. Tackifier - Non-toxic, organic, starch based, tackifier agent. Approved manufacturers are as follows
1. Rantec – "Supertac" or "R-Tack" products' www.ranteccorp.com
2. Chemstar – "Star Tak 600" product; www.chemstar.com

2.02 SOURCE QUALITY CONTROL

A. Inspection
1. Primarily for quality; however, other requirements are not waived even though visual inspection results in acceptance.
2. Inspection will be made periodically during seeding, at completion and at end of warranty period by Owner's representative.
3. Seed material is subject to inspection and acceptance. Owner's representative reserves the right to reject at any time or place prior to acceptance, any work and seed which in Owner's representative's opinion fails to meet specification requirements.
4. Inspections on seeded areas will be for the following items.
(a) Proper weed management and control (mechanical, chemical, mowing)

(b) Germination and performance of desired grass species
(c) Uniform coverage of desired grasses
(d) Performance of the irrigation system (if present)
(e) Watering practices (if applicable)
(f) Erosion control and management practices

B. Testing Requirements
1. Seed and seed labels shall conform to current State and Federal regulations and be subject to testing provisions of the Association of Official Seed Analysis.
2. The Owner's Representative may require tests of seed verification at the Contractor's expense.
3. All tags from seed bags shall be retained by the contractor and submitted to the Owner's Representative as a means to ensuring the proper seed rate and seed mixtures were applied to areas. If seed tags are not submitted it will be assumed that the area was improperly seeded and the contractor will apply a comprehensive herbicide to the space and reseed areas at their own expense.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions are as specified and indicated before beginning work under this section.

B. Layout
Verify layout of seeding areas as indicated prior to starting seeding operations.

C. Grades
Inspect to verify that rough grading is within 0.1 foot of grades specified and indicated.

D. Unsatisfactory Conditions
Report in writing to General Contractor with a copy to the Owner's representative.

E. Acceptance
Beginning of installation means acceptance of existing conditions by this Contractor.

3.02 PREPARATION

A. Protection
1. Be responsible for proper repair to landscape, utilities, fences, pavements and other site improvements damaged by operations under this Section.
2. Pay for repairs made by Contractor(s) designated by Owner.
3. Identify prepared seeding areas requiring protection and erect barriers for proper protection and traffic control.

B. Erosion Control
Take measures and furnish equipment and labor necessary to control and prevent soil erosion, blowing soil and accumulation of wind-deposited materials on the site throughout the duration of work.

C. Seeding Areas
Remove weeds, debris and rocks larger than ½" which may binder seeding or subsequent operations. Dispose of accumulated debris at direction of Owner's representative.

D. Fine Grading
Perform as required to maintain positive drainage, prevent ponding and direct run-off into catch basins, drainage structures, etc. and as required to provide smooth well-contoured surface prior to proceeding. Tolerance: + 0.04 foot within 50' of walks, roads, and high visibility areas. In large areas of open space that are intended to be natural in appearance, a "rougher grade" is more desirable as it provides better soil stability and micro-climates for seed growth and diversity.

E. Soil Preparation
   1. Soil preparation in all native seed areas is critical to the success and establishment of the plant material. Contractor is to ensure that all areas receive proper and adequate soil preparation.
   2. If the area to be developed is infested with noxious or invasive weeds, a chemical application will be required, at a rate recommended on the chemical's product label.

3.03 SEEDING

A. Drill or plant in manner such that after surface is raked and rolled, seed shall have 1/4" of cover. Accomplish seeding by 'Rangeland' type drills. Any furrows left by drill seeding in areas where fine grading within 0.04 foot is required, shall be rolled to a smooth surface. Smaller areas inaccessible with a seed drill can be hand broadcast and the seed can be raked into the surface.

B. If broadcast seeding is necessary, the seed rate shall be doubled.

C. Hydroseeding is not permitted on native seed areas indicated on plans.

D. On sloped or shaped areas, the first pass of the seeder shall attempt to follow the general contour. If multiple passes are required then the first pass and second passes should be close to perpendicular to each other. Each pass of the seeder should apply approximately ½ of the required seeding rate.

E. If not seeded between August 20th and October 20th, all other seeding types shall occur between May 1st and October 1st, unless otherwise approved by the Owner's Representative or specially stated within the plans.

F. One seeding shall occur between May 1st and June 1st.

G. The second seeding shall Occur between August 15th and October 1st.

H. Seeding may need to occur over consecutive landscape seasons as schedule requires.

I. The second seeding may be broadcast seeding or drill seeded depending on the amount of coverage developed from the first seeding. If there is insufficient coverage from the first seeding, it should be assume the second seeding will required hydromulching.

3.04 RESEEDING

Areas shall be reseeded if they exhibit areas greater than the acceptable amounts noted in Part 1 of this Section. Reseeding shall occur continually during the establishment period.

3.05 MULCH

A. Hydromulching is not permitted with native seed.

3.06 EROSION CONTROL

A. Apply erosion control netting to any area which is vulnerable to soil erosion such as swales or steep slopes.(5:1 or steeper slopes)

B. If Contractor fails to net such areas and soil erosion subsequently occurs, Contractor shall re-establish finish grade, soil preparation, seed bed, and apply jute netting at their own expense.

C. Erosion Control Netting
   1. Roll out in direction of flow after seeding and mulching.
   2. Apply material loosely and smoothly on soil surface without stretching and without tenting.
   3. Avoid walking directly on seed-bed either before or after material is applied.

3.07 NOTIFICATION AND INSPECTION

A. Inspection
   1. When seed and mulch are installed notify the Owner's Representative for inspection and to turn over seed tags.

2. When germination is complete, and plants are visible, the Contractor shall notify the Owner's Representative. The inspection will be used to determine if the area is substantially complete and if the warranty period should commence.
3. All washouts, thin, weak, or dead areas should be repaired prior to the inspection.

B. Deficiencies
1. Owner's representative will specify deficiencies to Contractor who shall make satisfactory adjustments and shall again notify Owner's representative for final inspection.

3.08 CLEANING

A. Remove debris and excess materials from site. Clean paved and finished areas soiled as a result from work under this section, in accordance with direction given by Owner's representative. Clean out drainage inlet structures.

B. Remove mulch, from seeding operations, immediately from fences, structures, walls, trees, shrubs and sod to prevent damage to same.

3.09 PROTECTION

Provide and install barriers as required and as directed by Owner's representative, or as needed to protect seeded areas from damage from pedestrian and vehicular traffic. Contractor is responsible for malicious destruction of seeding caused by others.

END OF SECTION

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SECTION 32 92 23
SODDING

PART 1 - GENERAL

1.01 SUMMARY

Furnish all supervision, labor, material, equipment, transportation, permits and fees, and perform all operations in connection with the installation of sod, where called for in plans and specifications.

1.02 REFERENCES

A. Reference Standards: U.S. Department of Agriculture Rules and Regulations under Federal Seed Act and equal in quality to standards for Certified Seed.

B. General Landscape Section

C. Fine Grading and Soil Preparation Section

1.03 SUBMITTALS

Refer to General Landscape Section.

1.04 QUALITY ASSURANCE

A. Sod Materials
Subject to inspection and acceptance. Owner's representative reserves the right to reject at any time or place prior to acceptance, any work and sod which in the Owner's representative's opinion fails to meet these specification requirements. Promptly remove rejected sod from site.

B. Inspection
1. Primarily for quality; however, other requirements are not waived even though visual inspection results in acceptance. Notify Owner's representative of intended sod farm prior to cutting for inspection. Inspection at growth site shall not preclude the right of rejection at project site.
2. Inspection will be made periodically during sodding, at completion and at end of warranty period by Owner's representative.
3. Inspection shall be scheduled prior to sodding. Owner's representative will inspect finish grades on which sod will be laid. This inspection does not dismiss the contractor's responsibility for creating positive drainage across the landscaped areas.

C. Sod Standards
1. General - Healthy, thick turf having undergone a program of regular fertilization, mowing and weed control; free of objectionable weeds; uniform in green color, leaf texture and density; healthy, vigorous root system; inspected and found free of disease, nematodes, pests and pest larvae by the entomologist of the State Department of Agriculture.
2. Each piece of Sod - Sandy-loam soil base that will not break, crumble or tear during sod installation.
3. Thickness – 5/8" minimum root zone thickness.
4. Thatch - Not to exceed ½" uncompressed.
5. Size - Cut in strips 18" wide no more than 24 hours prior to delivery.

1.05 DELIVERY, STORAGE AND HANDLING

A. Packing and Shipping
1. Deliver sod on pallets properly loaded on vehicles and with root system protected from exposure to sun, wind, and heat in accordance with standard practice and labeled with botanical and common name of each grass species in accordance with Federal Seed Act.
2. Protect sod from dehydration, contamination and heating at all times. Keep stored sod moist and under shade or covered with moistened burlap.
3. Do not drop sod rolls from carts, trucks or pallets.

B. Acceptance at Site
   1. Material shall be inspected upon arrival at job site.
   2. Immediately remove unacceptable material from job site.

C. Storage and Protection
   1. Do not stack sod more than 2 feet deep.
   2. Do not deliver more sod than can be installed within 24 hours. Storage is not recommended.

1.06 PROJECT/SITE CONDITIONS

A. Environmental Requirements:
Do not install sod on saturated or frozen soil unless otherwise directed by owner's representative.

B. Existing Conditions
   1. Import and place any fill material required to adjust the fine grade to meet drainage requirements or to match hard surface fine grades, or as indicated on plans (e.g., 1 inch lower than adjacent concrete trails).
   2. Vehicular accessibility on site shall be as directed by Owner's representative. Repair damage to prepared grounds and surfaces caused by vehicular movement during work under this section to original condition at no additional cost to Owner.

1.07 WARRANTY

A. Warranty sod for a period of one year from date of Substantial Completion be in a healthy, vigorous growing condition.

B. During the original warranty period, replace at once sod areas that die due to natural causes, etc., or which in Owner's representative's opinions are unhealthy.

C. Replacement will not be required in any season definitely unfavorable for sodding.

D. Install replacements as originally specified and warranted.

1.08 MAINTENANCE

1. The maintenance shall begin immediately after each area is sodded and continue until final acceptance of entire project. During this time, the contractor shall, be responsible for watering, mowing, spraying, weeding, aerating, fertilizing, and all related work as necessary to ensure that sodded areas are in a vigorous growing condition. Furnish all supervision, labor, material and equipment to maintain turf areas.

1.09 WATERING

A. Initially water sod upon completion of convenient work areas until installation is complete. Water sod sufficiently to moisten subsoil at least 4" deep in a manner not to cause erosion or damage to adjacent finished surfaces. Water shall be free of substances harmful to plant growth. Contractor responsible for furnishing water from underground sprinkler system, quick couplers or other source.

B. Contractor shall know, understand, and abide by all local water restrictions, if in effect.

C. Contractor will be held responsible for any fines received for violating any watering restrictions in effect.

D. The contractor shall attempt to provide the minimum water necessary to maintain irrigated landscape areas, especially in times of drought and during summer months. The owner or owner's representative will determine what appropriate level of distress is acceptable on turf areas.

E. Re-sodding
   1. Re-sod spots larger than nine inches square and not having healthy, uniform stand of grass.

F. Insect and Disease Control:
   1. As required, using insecticides and fungicides approved by Owner or Owner's Representative.

PART 2 - PRODUCTS

Refer to the General Landscape Section.

PART 3 - EXECUTION

3.01 EXAMINATION

A. General
   1. Verify that existing site conditions are as specified and indicated before beginning work under this section.

B. Layout
   1. Verify layout of sodded areas as indicated prior to starting operations.

C. Grades
   1. The owner's representative must inspect finished grades prior to installing any sod.

D. Unsatisfactory Conditions
   1. Report in writing to General Contractor with copy to Owner's representative.
   2. Beginning of installation means acceptance of existing conditions by this Contractor.

3.02 PREPARATION

A. Protection
   1. Pay for repairs made by contractors designated by Owner.
   2. Identify prepared sod areas requiring protection and erect barriers for proper protection and traffic control.

B. Sodding Areas
   1. Remove weeds, debris and rocks larger than ½" which may hinder sodding. Dispose of accumulated debris off-site in approved legal dump site, or in a location pre-approved by the owner or owner's representative.

C. Repair
   1. Re-establish grade and specified conditions to damaged sod areas prior to placing sod.

D. Weeding
   1. If the area to be developed is infested with noxious or invasive weeds, a chemical application will be required, at a rate recommended on the chemical's product label.

E. Fine Grading
   1. Perform as required to maintain positive drainage, prevent ponding and direct run-off into catch basins, drainage structures, etc., and as required to provide smooth well-contoured surface prior to proceeding. Tolerance: ± 0.04 foot.
   2. Unless noted on plans, tree lawns, or areas between curb and sidewalk, shall exhibit positive drainage towards the street. "Crowning", berming, or anything other than straight grading between these surfaces shall be rejected, unless otherwise waived by owner or owner's representative.
   3. Fine grading must be approved by both contractor and owner's representative prior to sodding. Contractor should provide at least two (2) calendar days notice for inspection. Sod shall be installed with in 48 hours of inspection. The contractor will be responsible for repairing any grades damage by inclement weather, before or after finish grades are inspected.

3.03 SODDING

A. Sodding

1. Soil on which sod is laid should be slightly moist.
2. Lay with longest dimension parallel to contours and in continuous rows.
3. Tightly butt ends and sides of sod together. Stagger and compact vertical joints between sod strips by rolling so sod will be incorporated with the ground surface, ensuring tight joints between adjacent pieces.
4. Where new sod meets existing, cut existing with sod cutter to insure a tight joint and smooth transition between new and existing turf cover.

B. Rolling
1. When soil and sod are moist, roll sod lightly as soon as possible after it is laid. Delay rolling until just before the second watering.

C. Topsoil
1. Add along exposed edges to match adjacent grade. Feather topsoil out approximately 1 ft. from edge of sod.

D. Drainage
1. Assure finished areas of sod are such that positive drainage of storm water will occur and ponding of water does not occur.

3.04 REPAIR OF EXISTING SOD AREAS DISTURBED BY RENOVATION

A. Repair existing sod areas disturbed by renovation work (utilities, paving, etc)., in accordance with these specifications to satisfaction of Owner.

B. Add topsoil and re-sod as necessary to eliminate tire ruts and other depressions.

3.05 NOTIFICATION OF INSPECTION

A. Notification
1. Give notice requesting inspection by Owner's representative at least seven (7) calendar days prior to the anticipated date of completion. All sod must be healthy and significantly rooted in place in order to be considered complete.

B. Deficiencies
1. If deficiencies exist, Owner's representative shall specify such deficiencies to the Contractor who shall make satisfactory adjustments and will again notify the Owner's representative for final inspection.

3.06 CLEANING

Remove pallets, unused sod, and other debris from site. Clean paved and finished surfaces soiled as a result of work under this Section in accordance with directions given by Owner's representative. Clean out drainage inlet structures.

3.07 PROTECTION

Provide and install barriers as required and as directed by Owner's representative, or as needed, to protect sodded areas against damage form pedestrian and vehicular traffic until acceptance by Owner. Contractor is responsible for malicious destruction of sodding caused by others until substantial completion.

END OF SECTION

SECTION 33 11 00
WATER UTILITY DISTRIBUTION PIPING

PART 1 - GENERAL

1.01 SCOPE

A. This section includes information common to water distribution system components and applies to all sections in this Division.

B. Delavan Water Utility shall be involved in the following tasks, but are not necessarily limited to, water main filling, flushing, testing, and live-tap installations. Schedule all Water Utility supplemental construction services to occur between the hours of 7:00 AM and 3:00 PM, Monday through Friday. Requests for construction services occurring outside of these hours will be subject to any associated overtime charges being billed to the Contractor. Delavan Water Utility reserves the right to decline any construction services which are requested to occur outside of the approved hours. No live-tap installations shall be scheduled to occur outside of the approved hours unless authorized in writing by Delavan Water Utility.

C. Contractor shall be solely responsible for obtaining all permits necessary to complete the work. Contractor shall pay all fees associated with obtaining permits. These include, but are not limited to permits for work within public right-of-way, street opening permits, testing, utility connection permits, plumbing permits and municipal fees for completing work (e.g. live taps and water connections to City main).

D. All work shall conform to the City of Delavan's Standard Specifications

END OF SECTION

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SECTION 33 30 00
SANITARY SEWERAGE UTILITIES

PART 1 - GENERAL

1.01 SCOPE

A. This section includes information common to sanitary sewage utilities and applies to all sections in this Division.

B. This specification shall apply to all sanitary sewer work beginning at a point five 5' outside of the building wall, unless otherwise specified.

C. Construct sewer system in a manner that will facilitate future extension or connection.

D. Review plans prior to installation and notify Construction Representative if proposed design does not appear to accommodate future extension or connection.

E. When drawings indicate future connection at a manhole or other structure, install a full length of pipe beyond the structure, providing plugged bell at terminal end of pipe. Provide marker board at terminal end of stubbed pipe.

F. Contractor, prior to excavation work, shall notify all utilities, governmental agencies, or entities, known to, or which can reasonably be assumed to, have above or below ground pipe, conduit cables, structures, or similar items within limits of project, to locate and mark location of such items. The Contractor shall expose potential pipe conflicts prior to installation of sewers to allow for any field changes to the design to be made.

1.02 REFERENCE STANDARDS

A. Work under this section depends on applicable provisions from other sections and the plan set in this contract. Examples of related sections include, but are not limited to:

1. Division 31 — Earthwork

B. ASTM - American Society for Testing and Materials

1. ASTM C425-04 Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings

2. ASTM C700-05 Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated

3. ASTM D1784-03 Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated

4. ASTM Poly (Vinyl Chloride) (CPVC) Compounds

5. ASTM D2235-04 Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings

6. ASTM D2564-04 Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems

7. ASTM D2680-01 Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Piping

8. ASTM D3034-04a Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings

9. ASTM D3212-96a (2003)e1 Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals

10. ASTM D3350-05 Standard Specification for Polyethylene Plastics Pipe and Fittings Materials

11. ASTM D4673-02 Standard Classification System for Acrylonitrile-Butadiene-Styrene (ABS) Plastics and Alloys Molding and Extrusion Materials

12. ASTM F477-02e1 Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

13. ASTM F679-03 Standard Specification for Poly Vinyl Chloride (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings

C. AWWA - American Water Works Association

1. AWWA C104/ANSI A21.4-95 Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water

2. AWWA C151/ANSIA21.53-00 Standard for Ductile Iron Pipe, Centrifugally Cast for Water or Other Liquids

3. AWWA C153/A21.53 Standard for Ductile Iron Compact Fittings for Water Service

D. Where these specifications do not cover portions of the work to be undertaken, the City of Delavan Standard Specifications for Public Works Construction, current edition, shall govern the work, hereafter called “Standard Specifications” in this spec section.

1.03 SUBMITTALS

A. Provide reports documenting pressure testing, mandreling, and televising.

B. Maintain record drawings that show the actual locations, sizes, and types of utilities and other features encountered.

C. Note any modifications to proposed sewer system size, location, or elevation. Record any other deviations from the drawings. Record drawings shall be in compliance with specification section 01 78 39 Asbuilt Drawings. Record drawings shall also include digital record site plans generated by the land surveyor contractor.

PART 2 - PRODUCTS

2.01 PIPE

A. Provide the size, type, and class/schedule of pipe as indicated on the drawings.

B. Use only pipe supplied from the same manufacturer, and of the same type, unless otherwise specified or approved in advance by the Engineer.

C. Only pipe, joints, material, and installation approved by Wisconsin Department of Natural Resources and/or the Department of Commerce for the intended use in the State of Wisconsin shall be used.

D. Install all pipe in accordance with ASTM specifications which pertain to the specified type of pipe material and the installation situation.

E. Do not use any pipe or fittings cracked in cutting or handling or otherwise not free from defects.

F. Clean all pipe of any dirt and/or debris both inside and out prior to placing in the trench.

G. Make joints in accordance with manufacturer's directions with due care to avoid damaging pipe and/or disturbing previously laid pipe.

H. Cut pipe only according to manufacturer's directions.

I. Lay all sewer pipes to horizontal alignment and grade shown on the plans with bell ends up hill. Establish and maintain horizontal alignment using total station, transit, or theodolite. Use pipe laser or level to establish and maintain grade of pipe. Discrepancies from the required horizontal alignment or grade at any location shall not be greater than 0.10’ or 0.05’, respectively.

J. Do not exceed specified trench widths.

2.02 PVC PIPE

A. Polyvinyl Chloride (PVC) pipe fittings shall meet the requirements for type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings of ASTM D3034 for pipe sizes up through 15 inches and ASTM F679 for pipe sizes 18 inches through 36 inches. All PVC sanitary sewer pipe shall have a maximum standard dimension ratio (SDR) of 35.

B. The wall thickness shall conform to requirements for a T-1 wall per ASTM F69-01. PVC material shall have cell classification 12454-B or 12454-C as defined in ASTM D1784 with minimum modulus of elasticity of 400,000 psi in tension. Pipe stiffness shall be minimum 46 psi when tested in accordance with ASTM D2412.

C. Acceptance of piping shall be subject to tests conducted by an approved testing agency.

D. Pipe and fittings shall be the product of one manufacturer and the manufacturer shall have experience records substantiating acceptable performance of the pipe to be furnished.

E. Fittings such as saddles, elbows, tees, wyes, and others shall be of material and construction corresponding to and have a joint design compatible with the adjacent pipe. Approved adapters shall be provided for transitions to other types of pipe. Fittings shall be injection molded PVC.

F. Joints shall be of the elastomeric type. Elastomeric joints shall be a bell and spigot joint conforming to ASTM D3212 sealed by a rubber gasket conforming to ASTM F477 so that the assembly will remain watertight under all conditions of service, including the movements resulting from the expansion, contraction, settlement, and deformation of the

pipe. Bells shall be formed integrally with the pipe and shall contain a factory installed positively restrained gasket.

2.03 CONNECTIONS FOR DISSIMILAR PIPE MATERIALS

A. Where new sewer connects to and existing dissimilar pipe, the connection shall be made with a no hub type coupling meeting the requirements of CISPI 310. Couplings shall have neoprene gaskets with stainless steel shield, and multiple stainless-steel clamps with worm gear tightening device. The couplings shall be made specifically for the type and size of pipe materials being connected. Couplings shall be Fernco RC Strongback.

2.04 PIPE INSULATION

A. Rigid closed cell extruded polystyrene insulation shall be suitable for buried insulation.

B. Individual boards shall have dimensions of 8” x 4” x 2”.

C. Insulation shall follow the requirements of COMM Code82.

D. Dow Styrofoam, or approved equal.

E. Provide insulation when indicated on the drawings or where depth of cover is less than 6’. Unless otherwise noted, install 2” thick polystyrene board insulation.

F. Install insulation on compacted initial cover material, 6” above the top of pipe. Stagger joints where more than one layer of insulation is required. Provide insulation with a minimum of 1’ of initial cover material. Place cover and backfill material in a manner that does not damage insulation; replace any damaged insulation.

PART 3 - EXECUTION

3.01 BEDDING/INITIAL COVER

A. Sanitary sewer and sewer services shall be provided with 4” of bedding material and 12” of initial cover material (both measured at the bell of the pipe).

B. Crushed stone bedding shall be used for both bedding and initial cover.

C. Backfill within paved areas of R.O.W. shall consist of aggregate slurry.

3.02 CONNECTIONS TO EXISTING STRUCTURES

A. Make all necessary openings into existing structures or sewers including the reconstruction of existing inverts or benches, as necessary. Patch all openings permanently watertight with concrete brick and mortar, or hydraulic cement and water stops, or for sanitary sewer, hydraulic cement, and flexible watertight boots.

3.03 SEWER LATERALS

A. Connect existing sewer laterals in accordance with all of the requirements of the sewer mains, including bedding, backfill, compaction and jointing of the pipe. Connect sewer laterals to the sewer main by means of an approved “wye” fitting. Connect the new pipe to the existing lateral material using a no-hub coupling or approved transition fitting. Coupling/fitting shall be selected for the specific pipe material being connected.

B. Subject to local municipality requirements, cut-in type saddle wyes are permitted on existing sanitary sewers where service laterals are to be connected to the sewer. Unless otherwise indicated, the saddle fitting shall be gasketed PVC with stainless steel bands and hardware.

3.04 ELECTRONIC MARKERS OVER LATERAL

A. Each sanitary lateral shall have a minimum of 2 electronic markers: One shall be located above the wye on the sewer main, and one shall be located above the lateral at the property line. Additional markers shall be placed at each change in horizontal direction. Markers shall be installed per manufacturer's written instruction.

B. The key constraint is the maximum depth of the marker. The signal range of the 3M™ Electronic Marker System (EMS) 4" EXTENDED RANGE 5' BALL MARKER - WASTEWATER (MODEL 1404-XR) is 5 feet.

C. Upon completion, the City will test each electronic marker to confirm that it is installed and functioning properly. If it is determined that the marker has not been installed correctly and/or is not functioning properly, the contractor will be responsible for all work associated with the installation of a properly functioning marker.

3.05 LEAKAGE TESTING

A. All new sanitary sewer lines shall be leakage tested in accordance with the Low-Pressure Air Test per 501.3(b).

3.06 SEWER TELEVISING

A. Sanitary sewers may be videotaped by OWNER. If videotaping reveals a defect that requires repair, CONTRACTOR shall reimburse OWNER for cost of videotaping that section of pipe. All sanitary sewers with defects, including but not limited to cracked or deformed pipe, misaligned joints, unsealed lift holes, and incorrect gradelines, as identified through videotaping, shall be re-laid, or shall be paid for at 50% of the price bid. Relaying the pipe or reducing payment shall be at OWNER's discretion.

B. The Contractor shall provide to the Construction Representative with 2 copies of the televising tape or DVD.

3.07 ABANDON SEWER

A. Where indicated on the plans, existing sewer to be left in

B. Place shall be abandoned in accordance with the Standard Specifications. Sewer shall not be abandoned until existing services have been reconnected to the replacement sewer. Abandoning sewers is considered incidental to the construction.

C. In paved areas or current/future building pad areas, existing storm sewer facilities are required to be abandoned as follows:

1. Remove existing pipes or fill them with sand or grout and seal ends with a minimum 2-foot-thick grout plug.

2. Remove existing inlets, catch basins, and manholes to at least 4 feet below finished grade. Provide a minimum 6-inch hole in the bottom of the structure and fill the remaining portion with bedding stone.

END OF SECTION

SECTION 33 40 00
STORM DRAINAGE UTILITIES

PART 1 - GENERAL

1.01 SCOPE

A. This section includes information common to storm drainage utilities and applies to all sections in this Division.

B. The work under this section shall consist of providing all work, materials, labor, equipment, and supervision necessary to provide for the storm sewer work required in these specifications and on the drawings. This specification shall apply to all storm sewer work beginning at a point 5' outside of the building wall, unless otherwise specified.

C. Construct sewer system to convey flow from the bioretention areas.

D. Review plans prior to installation and notify Construction Representative of any concerns.

E. Contractor, prior to excavation work, shall notify all utilities, governmental agencies, or entities, known to, or which can reasonably be assumed to, have above or below ground pipe, conduit cables, structures, or similar items within limits of project, to locate and mark location of such items. The Contractor shall expose potential pipe conflicts prior to installation of sewers to allow for any field changes to the design to be made.

1.02 REFERENCES

A. Work under this section depends on applicable provisions from other sections and the plan set in this contract. Examples of related sections include, but are not limited to:

1. Division 31 — Earthwork

B. ASTM - American Society for Testing and Materials

1. ASTM C76-05b Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe

2. ASTM C443-05a Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets

C. Where these specifications do not cover portions of the work to be undertaken, the City of Delavan Standard Specifications for Public Works Construction, current edition, shall govern the work.

1.03 SUBMITTALS

A. Provide manufacturers product information, for storm sewer materials including pipe, fittings, structure, outfalls, and castings.

B. Provide reports documenting any required testing.

C. Maintain record drawings that show the actual locations, sizes and types of utilities and other features encountered. Record drawings shall be in compliance with specification section 01 78 39 Asbuilt Drawings. Record drawings shall also include digital record site plans generated by the land surveyor contractor.

D. Note any modifications to proposed sewer system size, location, or elevation. Record any other deviations from the drawings.

PART 2 - PRODUCTS

2.01 PIPE (GENERAL)

A. Provide the size, type and class/schedule of pipe as indicated on the drawings.

B. Use only pipe supplied from the same manufacturer, and of the same type, unless otherwise specified or approved in advance by the Engineer.

C. When applicable, only pipe, joints, material, and installation approved by Wisconsin Department of Natural Resources and/or the Wisconsin Department of Safety and Professional Services (SPS) for the intended use in the State of Wisconsin shall be used.

2.02 REINFORCED CONCRETE PIPE

A. Pipe and fittings shall conform to ASTM C-76 for circular pipe and ASTM C-507 for elliptical pipe. Unless otherwise specified, provide Class III for circular pipe and Class HE-III for elliptical pipe.

B. Joints for reinforced concrete pipe shall be bell and spigot or tongue and groove. Joints shall be provided with rubber gaskets conforming to ASTM C433. Joints for elliptical pipe shall be provided with trowelable impervious bituminous joint sealer that is manufactured for sealing reinforced concrete sewer pipe joints.

C. When required, external sealing bands shall meet the requirements of ASTM C877 (Type II), and shall be Mar Mac Mac Wrap, or approved equal.

2.03 PVC PIPE (SOLID)

A. Conform to ASTM D-3034 with solvent weld or elastomeric joints. Pipe shall be SDR-26, unless otherwise noted. Pipe over 15 inches in diameter shall meet the requirements of ASTM F679-03.

B. The wall thickness shall conform to requirements for a T-1 wall. PVC material shall have cell classification 12454-B or 12454-C as defined in ASTM D1784 with minimum modules of elasticity of 400,000 psi in tension. The pipe wall shall be homogeneous and contain no seams. Minimum pipe stiffness per ASTM D2412 shall be 60 psi for pipe sizes through 18-inch and 46 psi for 21-inch and larger pipe sizes. Pipe shall withstand impact of 210 foot-pounds for pipe sizes through 8-inch and 220 foot-pounds on larger sizes.

C. Pipe and fittings shall be the product of one manufacturer and the manufacturer shall have experience records substantiating acceptable performance of the pipe to be furnished.

D. Fittings shall be injection molded. Fittings such as saddles, elbows, tees, wyes, and others shall be of material and construction corresponding to and have a joint design compatible with the adjacent pipe. Approved adapters shall be provided for transitions to other types of pipe.

E. Joints shall be of the elastomeric type. Elastomeric joints shall be a bell and spigot joint conforming to ASTM D3212 sealed by a rubber gasket conforming to ASTM F477 so that the assembly will remain watertight under all conditions of service, including the

movements resulting from the expansion, contraction, settlement, and deformation of the pipe. Bells shall be formed integrally with the pipe and shall contain a factory installed positively restrained gasket.

F. All exposed end sections shall be provided with steel apron end walls.

2.04 HDPE PIPE (SOLID WALL AND SLOTTED)

A. Conform to ASTM-D-3350 for PE material with a cell classification of 335434C or better. Pipe shall be thermal butt fusion in accordance with manufacturer's recommendation.

B. Perforates pipe shall be Slotted HDPE pipe; ADS N12 with AASHTO Class I perforations or approved equal.

2.05 CONNECTIONS FOR DISSIMILAR PIPE MATERIALS

A. Where new sewer connects to and existing dissimilar pipe, the connection shall be made with a no hub type couplings meeting the requirements of CISPI 310. Couplings shall have neoprene gaskets with stainless steel shield, and multiple stainless-steel clamps with worm gear tightening device. The couplings shall be made specifically for the type and size of pipe materials being connected. Couplings shall be Fernco RC Strongback.

2.06 ROUND CATCH BASINS

A. Round catch basins shall be 48” (MIN) inside diameter precast concrete unless otherwise shown or required. (See plans for specific sizes.)

B. Submit manufacturer's preproduction (shop) drawings for approval prior to the start of manufacturing.

C. Contractor shall carefully locate all pipe locations, sizes, orientation, and elevation prior to ordering catch basin.

D. Round catch basins shall meet the requirements of ASTM C478.

E. Pre-cast catch basin wall thickness shall be minimum of 5”.

F. Provide 8” (min.) thick pre-cast catch basin base. Catch basin bottom section may be pre-cast with integral base.

G. Catch basins shall be provided with precast reinforced concrete in-bell cover designed to accommodate AASHTO H20 loading. In-bell cover shall be provided with 24” opening for casting.

H. Joints

1. Catch basins requiring separate base and riser sections must be provided with standard pipe tongue and groove joints.

2. Seal joints watertight with prefabricated rubber or plastic gaskets or formed in place butyl rubber seal.

3. Joint sealers shall be Kent Seal, ConSeal or approved equal circular o-ring conforming to ASTM C443: Ramnek, Mas-Stik, butyl rubber gasket, or butyl rubber rope.

I. Connections

1. Provide custom knock-outs/cut-outs based on project and location specific conditions.

2. A minimum of 2” of the precast structure is required between the top of a knock-out/cut-out and the top of the structure. A minimum of 2” of precast structure is required between the side of a knock-out/cut-out and the inside face of an adjacent sidewall.

J. Steps

1. Provide steps at 16 inches o.c.± and project approximately 6" from wall.

2. Unless otherwise indicated on the drawings, locate steps over the downstream pipe opening.

3. Steps shall be steel reinforced polypropylene with 1/2-inch diameter deformed reinforcing bar. Steps shall be permanently secured in the catch basin wall. Steps shall be M.A. Industries No. PS1-PF or approved equal.

K. Flowline

1. Provide either pre-cast or cast-in-place flowline that provides positive flow through the structure. Provide bench that directs water towards the flowline.

2. Flowlines and benches shall be formed with gradual, uniform sweeps directed towards the downstream pipe. Provide smooth, troweled finish for flowlines.

L. Adjusting Rings

1. Adjusting rings shall be injection molded high density polyethylene (HDPE), manufactured by Ladtech, IPEX, or equal. Joints shall be sealed with approved silicone or butyl sealant in accordance with manufacturer's recommendations. Materials shall conform to ASTM D-1248 using 100% recycled material. Rings shall be tested to assure compliance in meeting H-20 loading capacity per AASHTO Standards.

2. Where casting adjustment requirements cannot be met by the use of HDPE adjustment rings and upon ENGINEER's approval, CONTRACTOR shall provide precast concrete adjusting rings. Fiber-reinforced pre-cast concrete adjusting rings meeting the requirements of ASTM C-478. Provide rings of 2” or 4” thickness.

3. Precompressed butyl gasket, 3/8”x3 ½” shall be used between the top of the manhole and first adjustment ring, and between all subsequent rings. Butyl material shall be E-Z Stick, or equal.

2.07 CASTINGS

A. All castings shall be heavy duty iron conforming to ASTM A48, Class 20 and rated for AASHTO H-20 loading. Provide non-rocking or machined castings with concealed pick hole.

B. Frames and grates shall be as noted on the plans.

C. Install casting type as indicated on the plans or in the specifications. If the plans and specifications are in conflict, the plans shall govern.

D. Provide butyl sealant material between last adjusting ring and casting base. Adjust casting elevation and slope to match adjacent proposed grades.

PART 3 - EXECUTION

3.01 LAYING PIPE

A. Install all pipes in accordance with ASTM specifications which pertain to the specified type of pipe material and the installation situation.

B. Do not use any pipe or fittings cracked in cutting or handling or otherwise not free from defects.

C. Clean all pipe of any dirt and/or debris both inside and out prior to placing in the trench.

D. Make joints in accordance with manufacturer's directions with due care to avoid damaging pipe and/or disturbing previously laid pipe.

E. Cut pipe only according to manufacturer's directions.

F. Lay all sewer pipes to horizontal alignment and grade shown on the plans with bell ends up hill. Establish and maintain horizontal alignment using total station, transit, or theodolite. Use pipe laser or level to establish and maintain grade of pipe. Discrepancies from the required horizontal alignment or grade at any location shall not be greater than 0.10’ or 0.05’, respectively.

G. Do not exceed specified trench widths.

3.02 BEDDING/INITIAL COVER

A. Provide bedding and initial cover in accordance with the City and/or County Standard Specifications for Public Works Construction, current edition.

B. Storm sewer and sewer services shall be provided with 4” of bedding material and 12” of initial cover material (both measured at the bell of the pipe). Crushed Stone Bedding shall be used for both bedding and initial cover.

3.03 STRUCTURES (INLETS AND CATCH BASINS)

A. Contractor shall determine the proper location, size, elevation, and orientation of all pipes entering new structures before ordering. Do not connect abandoned pipes to new structures. Structures having improper location and/or orientation of the pipe connections will be rejected. Field repairs or adjustments of connection points are not permitted.

B. Limit the excavation for structures so as to provide only the necessary amount of space to sufficiently prepare the subgrade, set the base, set the structure, and lay pipe. Provide a minimum of 1’ of clearance between structure and trench wall for adequate backfilling and compaction.

C. Where excavation occurs below the bottom elevation of the structure's base, bring the excavation to the required elevation by the use of compacted crushed stone bedding. A

minimum of 8 inches of compacted Crushed Stone Bedding shall be placed below the bottom of the structure base.

D. Set structure base in accordance with elevation and location as indicated on the plans. Install base plumb and level. Install subsequent pre-cast sections in accordance with shop drawing layout. Provide watertight gaskets between each section.

E. Pour inverts with smooth surface draining to downstream pipe. Where two or more lines meet at an angle, provide curved channel. Slope bench or floor at 2 inches/ft towards flow channel.

F. Structures shall be provided with between 4” and 8” of adjusting rings, with the top adjusting ring being 2” thick. Provide butyl sealant material between rings. Once rings are in place, tuck point the exterior joint and provide the entire exterior surface of the adjusting ring riser with a coating of mortar.

3.04 CONNECTIONS TO EXISTING STRUCTURES

A. Make all necessary openings into existing structures or sewers including the reconstruction of existing inverts or benches, as necessary. Patch all openings permanently watertight with concrete brick and mortar, hydraulic cement, or flexible watertight boots.

3.05 ELECTRONIC MARKERS OVER LATERAL

A. Each sanitary lateral shall have a minimum of 2 electronic markers: One shall be located above the wye on the sewer main, and one shall be located above the lateral at the property line. Additional markers shall be placed at each change in horizontal direction. Markers shall be installed per manufacturer’s written instruction.

B. The key constraint is the maximum depth of the marker. The signal range of the 3M™ Electronic Marker System (EMS) 4” EXTENDED RANGE 5’ BALL MARKER - WASTEWATER (MODEL 1404-XR) is 5 feet.

C. Upon completion, the City will test each electronic marker to confirm that it is installed and functioning properly. If it is determined that the marker has not been installed correctly and/or is not functioning properly, the contractor will be responsible for the all work associated with the installation of a properly functioning marker.

3.06 LEAKAGE TESTING

A. Storm sewers shall be visually inspected for excessive water infiltration and soil leakage into sewers or structures. Contractor shall repair/correct any infiltration or soil leakage that is considered excessive by the Construction Representative.

3.07 SEWER TELEVISING

A. Storm sewers may be videotaped by owner. If video recording reveals a defect that requires repair, the CONTRACTOR shall reimburse the OWNER for the cost of videotaping that section of pipe. All storm sewers with defects, including but not limited to cracked or deformed pipe, misaligned joints, unsealed lift holes, and incorrect gradelines, as identified through videotaping, shall be re-laid or shall be paid for at 50% of the price bid. Relaying the pipe or reducing payment shall be at OWNER's discretion.

3.08 ABANDONMENT OF EXISTING STORM SEWER FACILITIES

A. Where indicated on the plans, existing sewer to be left in place shall be abandoned in accordance with the City Delavan Standard Specifications for Public Works Construction. Sewer shall not be abandoned until existing services have been reconnected to the replacement sewer. Abandoning sewers is considered incidental to the construction.

B. In paved areas or current/future building pad areas, existing storm sewer facilities are required to be abandoned as follows:

1. Remove existing pipes or fill them with sand or grout and seal ends with a minimum 2-foot-thick grout plug.

2. Remove existing inlets, catch basins, and manholes to at least 4 feet below finished grade. Provide a minimum 6-inch hole in the bottom of the structure and fill the remaining portion with bedding stone.

END OF SECTION

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