SECTION 08 40 00 - EXTERIOR ENCLOSURE SYSTEM REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide the Work of this Section in accordance with requirements of the Contract Documents.

B. Controlling Section: This Section is a master controlling section that governs the general requirements for the design, integration, fabrication, installation, and testing of the whole building exterior enclosure system comprising vertical and sloped exterior surfaces and soffits and overhangs of the Project. Roofing, canopies, subgrade systems are covered in separate sections. The Exterior Enclosure System includes but is not limited to the following Assemblies:
1. Masonry veneer assemblies.
2. Aluminum framed assemblies consisting of curtain wall, entrance doors and storefront framing with fixed glazing assemblies, and aluminum plate spandrel panels.
3. Rain screen wall assemblies consisting of aluminum plate panels.
4. Steel supported glazing assemblies.

C. Controlled Sections: Controlled Sections are subservient to the requirements of this section. Assemblies of the Exterior Enclosure System are specified in the following Controlled Sections
1. Division 08, Section 08 44 13 "Glazed Aluminum Curtain Walls."
2. Division 08, Section 08 41 13 "Aluminum-Framed Entrances and Storefronts."
3. Division 08, Section 08 80 00 "Glazing".
4. Division 08, Section 08 91 19 "Fixed Louvers".

D. Related Sections and Components of the Exterior Enclosure System are specified in the following Related Sections:
1. Division 01, Section 01 81 13 "Sustainable Design Requirements".
2. Division 04, Section 04 20 00 "Unit Masonry".
3. Division 05, Section 05 12 00 "Structural Steel Framing".
4. Division 05, Section 05 40 00 "Cold-Formed Metal Framing".
5. Division 06, Section 06 16 00 "Sheathing".
6. Division 07, Section 07 21 00"Thermal Insulation".
7. Division 07, Section 07 52 16 "Modified Bituminous Membrane Roofing".
8. Division 07, Section 07 62 00 "Sheet Metal Flashing and Trim".
9. Division 07, Section 07 27 20 "Sheet Membrane Air Barriers".
10. Division 07, Section 07 27 26 "Fluid Applied Air and Water Barriers".
11. Division 07, Section 07 42 16 "Metal Plate Wall Panels".
12. Division 07, Section 07 84 46 "Fire-Resistive Joint Firestopping".
13. Division 07, Section 07 92 00 "Joint Sealants".
14. Division 07, Section 07 95 13.16 "Exterior Expansion Joint Cover Assemblies".
15. Division 08, Section 08 11 16 "Hollow Metal Doors and Frames".
16. Division 08, Section 08 33 23 "Overhead Coiling Doors".
17. Division 08, Section 08 71 00"Door Hardware".

E. Design Modifications: The design presented as part of the construction documents is a baseline criteria indicating design intent with required profiles, materials and configurations.
1. Submit modifications necessary to meet the design intent, performance requirements and field coordination. Variations in details or materials shall not adversely affect the design intent, appearance, durability or strength of components. Maintain the general design concept without altering size of members, profiles and alignment.

2. Design, engineer, and provide framing, miscellaneous support and anchorages to support proposed Assemblies.

1.2 DEFINITIONS

A. Exterior Enclosure System: An integrated series of assemblies, necessary for a complete airtight and weathertight system designed to withstand the indicated design loads and meet the other indicated performance parameters.

B. Assemblies: An assembly is an arrangement of components that forms a "standalone" part of the exterior enclosure system. Assemblies are delivered by contractors who specialize in particular materials or details associated with that assembly.

C. Components: Components are the building blocks of assemblies. Components may be a full panel (such as in a unitized curtain wall), a subassembly (such as an operable sunshade with motors and controls) or a single item (such as a screw).

D. Weather Line: The weather line shall be defined by the air and vapor barrier or control layer(s). The outer line shall protect the inner line from the greater majority of water and UV radiation that may strike the System. The inner line shall be an air and water barrier. If a vapor barrier is required, it shall be located at the inner line.

E. Exterior Enclosure System Contractor: The entity responsible for the total exterior enclosure system, including assemblies, components and interfaces with each other and interfaces with non-exterior enclosure system assemblies and components.

F. Non-Exterior Enclosure System: Assemblies not in the exterior enclosure system scope.

G. Architect: The Architectural/Engineering designers. Also includes their subconsultants.

1.3 PREINSTALLATION CONFERENCE

A. Prior to the start of the exterior enclosure work, and at the Exterior Enclosure System Contractor's direction, meet at the site and review the installation procedures and coordination with other work.

B. Meeting shall include Architect, the Commissioning Agent, the Owner's Representative, the Special Inspector, Contractor, Construction Manager, steel erector, curtain wall installer, sealant installer, as well as any other subcontractors or material technical service representatives whose work, or products, must be coordinated with the exterior enclosure work.

C. Agenda: Review material selections, availability of materials, personnel, equipment, and facilities needed to make progress and avoid delays, methods and sequence of exterior wall installation, structural load limitations, special details and conditions, standard of workmanship, quality control requirements, testing, inspecting, and certifying procedures, job organization, coordination with other trades, and other pertinent topics related to the Work

1.4 ACTION SUBMITTALS

A. Exterior Enclosure System Contractor shall submit the following:

1. Project Experience: Submit list of relevant projects documenting experience. List should include at least 5 projects carried out within the last 10 years of comparable size and scope.
2. Team Member Experience. Submit description of Key Team members' relevant experience. At a minimum, this shall include the proposed Project Manager and Professional Engineer.
3. List of Exterior Enclosure System Suppliers: Within 21 days of award of Contract, submit final listing of products, manufacturers and fabricators for the exterior enclosure system assemblies and components. Review of listed firms will be tentative, subject to review of subsequent submittals. Submit complete list of manufacturer's data and samples required by other Sections of these specifications, prior to submission of associated Shop Drawings.
4. System Description: Written and graphic descriptions for each component of each assembly, including details of construction relative to materials, dimensions of individual components, profiles, and finishes.
5. Product Data: For each type of product. Include material descriptions, dimensions of individual components and profiles and finishes.
6. Preliminary Drawings: Contract Drawings prepared by design professionals for this Project convey the design intent and specifications set the Performance Criteria for the Work of this Contract. While drawings show the overall profiles and dimensions, how those profiles are realized, and the engineering and detailing required to maintain profiles are the responsibility of the Exterior Wall Contractor.
7. Quality Assurance and Quality Control Program: Provide shop and field quality assurance and quality control program, along with an explanation of how the plan's procedures have been applied to projects similar in material, design, complexity and extent to this Project.
8. Preliminary Schedule: Submit a preliminary schedule for the Exterior Enclosure System. Include design, material procurement, fabrication, installation, testing and allowance for Client approval.
9. Certification: Provide certification signed by officer of company attesting that proposed assemblies comply with specified requirements, evidencing that the proposer has the production capability to perform the work according to the agreed schedule, and that the proposer has inhouse engineering and fabrication capability, that the shop drawings and engineering drawing shall be prepared under the supervision of the proposer's Professional Engineer, licensed to practice in the State of Texas.
10. Architect's/Consultant's Review: Review of preliminary proposal documents is for verification of each proposer's compliance with the Contract Documents. This review shall not constitute approval of the drawings, nor a waiver, abridging, nullifying or otherwise relieving the Sub-Contractor of his responsibilities described in the Contract Documents. Include BECxP in preliminary proposal document review.
11. Shop Drawings and Fabrication Engineering and Design: Submit Shop Drawings and fabrication engineering and design for each element of the Exterior Enclosure System as required by this specification and individual technical Sections. Comprehensive engineering analysis, including calculations that demonstrate submittal compliance with specified performance requirements and design data, shall be submitted concurrently with the relevant Shop Drawings or review may be delayed.
    a. Visual Mockup: Submit shop drawings of visual mockups.
    b. Production Shop Drawings and Calculations: After completion of mockup testing, submit production shop drawings and calculations prepared by or under the supervision of the Exterior Wall Contractor's Professional Engineer licensed to practice in the State of Texas. Incorporate required remedial work as a result of the mockup test results. Show scaled elevations, plans, and sections for each entire Assembly. Provide full scale sections for details of Assemblies that cannot be shown in the elevations or sections. Indicate thicknesses, finishes and all other information necessary or requested by the Architect to indicate compliance with the Contract Documents.

1) Clearly indicate details of field connections and anchorage and their relationship to the work of others. Show details of fastening, sealing methods and product joinery.
2) Include details for:
   a) Provisions of expansion and contraction
   b) Building movements.
   c) Draining moisture occurring within the assembly to the exterior.
3) For entrance doors, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.
4) Include full-size isometric details of intersection of Assemblies, showing the following:
   a) Joinery, including concealed welds.
   b) Anchorage.
   c) Expansion provisions.
   d) Glazing.
   e) Flashing and drainage.
5) Provide full assembly drawings. Piece and Die Drawings will not be reviewed.

c. Final Shop Drawings and Calculations of Curtainwall Assemblies shall bear the signature of the Exterior Wall Contractor's licensed Engineer, licensed in the state of Texas.

12. Samples: Submit samples required in Related Sections.
13. LEED Submittals: Provide LEED submittals in accordance with administrative and procedural requirements of Division 01, "General Requirements" and the specific requirements of the technical Sections of the specifications contained in Divisions 02 through 49.
14. Structural Calculations: Submit project specific structural calculations to show compliance with Drawings and Specifications.
15. Thermal Calculations, Thermal/Optical/Solar Simulation or Certificates: Submit thermal Model to show compliance with thermal and moisture control requirements specified in this Section and related sections controlled by this section. Thermal calculations and thermal modeling shall include transition between systems, i.e., roofing and curtainwalls, parapets, canopies, entrances and openings and other adjacent systems that comprise the thermal envelope.

B. Sustainable Design Submittals:
1. Building Product Disclosure and Optimization - Sourcing of Raw Materials:
   a. Recycled Content: For products having recycled content, indicate percentages by weight of post-consumer and pre-consumer recycled content.
      1) Include statement indicating costs for each product having recycled content.
   b. Regional Materials: For products that are required to comply with requirements for regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material.
      1) Include statement indicating distance to Project, cost for each regional material and the fraction by weight that is considered regional.

1.5 INFORMATION SUBMITTALS

A. Fabrication Engineering and Design Submittal: For exterior enclosure systems indicated to comply with performance requirements and design criteria, include comprehensive engineering analysis signed and sealed by a state of Texas professional engineer responsible for their preparation, indicating compliance with performance requirements specified.
1. Calculations shall be submitted concurrently with the relevant Shop Drawings or review may be delayed.

2. Shop Drawings shall contain the seal of the Exterior Wall Contractor's Professional Engineer licensed to practice in the state of Texas.

B. Coordination Drawings: Submit coordination drawings incorporating shop drawings of Assemblies that make up the Exterior Enclosure System. Submit elevations drawn to scale, indicating interfaces between various Assemblies and Non-Exterior Enclosure System Assemblies, and coordinating penetrations and wall-mounted items. Indicate the following:
   1. Assembly types that make up the whole Exterior Enclosure System.
   2. Primary and secondary support steel framing.
   3. Wall-mounted items including but not limited to doors, louvers, and lighting fixtures.
   4. Anchorages, embedments and attachments for each component.
   5. The air, water and vapor barriers.

C. Test Reports: Submit certified product test reports based on tests performed by Qualified Testing Laboratories clearly describing in written form, and in shop drawing form, compliance of each Assembly with the requirements indicated.

D. Fire Testing: Submit testing showing that exterior wall assembly as proposed for the project has been tested and passes NFPA 285.
   1. The configuration of the test assembly that is submitted for compliance must have been tested with a vertical joint that is centered on the opening and must have a horizontal joint no more than 3 feet above the opening of the test specimen. Other configurations will not be acceptable.
   2. The test assembly shall replicate in detail the proposed final wall assembly in all respects.

E. Building Information Management (BIM) Comply with requirements of the Contract and Division 01 "General Requirements" for Building Information Management requirements of the project. Comply with items specified in Division 01 Section "Submittals" for submittal requirements

F. Quality Assurance and Quality Control Program: Submit current copy of inplace comprehensive quality assurance and quality control program, along with an explanation of how the plan's procedures have been applied to projects similar in material, design, and complexity to this Project.
   1. Submit name and telephone number of individual selected by fabricator to be responsible for monitoring inhouse quality on a daily basis when the Owner's consultant is not present

G. Certifications:
   1. Document Review: Before starting work, submit a written statement, signed by the Contractor and Manufacturer/Fabricator certifying that the Contract Documents, shop drawings and product data have been reviewed with material manufacturer's qualified technical representatives and that they agree that selected materials are proper and compatible with contiguous materials and adequate for application shown.
   2. Certification of Application: Submit certification stating that the completed exterior wall complies with these Specifications, that the component parts were properly designed or selected for the application, and that installation methods comply with manufacturers' printed instructions and their field representatives' instructions, were proper and adequate for condition of installation and use in each case, signed by the contractor and single firm awarded the exterior wall work.

H. Qualification Data: For qualified Installer/Erector, Professional Engineer, and testing agencies for preconstruction and field testing.

1. Installer certificates signed by manufacturer certifying that installers comply with requirements in "Quality Assurance" Article.

I. Welder Qualifications: Submit welder qualifications in accordance with AWS standards.

J. Welding certificates indicating that welders comply with requirements specified in "Quality Assurance" Article and defining welding procedures to be used on the project.
1. Field quality-control reports.

K. Sustainable Design Submittals:
1. Building Product Disclosure and Optimization - Environmental Product Declarations
a. Submit product specific type III EPDs or Industry wide (generic) EPDs, USGBC approved program declaration or products with a publicly available, critically reviewed life-cycle assessment conforming to ISO 14044 that have at least a cradle to gate scope.
2. Building Product Disclosure and Optimization - Material Ingredients
a. Material Ingredient Reporting: Submit documentation confirming chemical inventory of products to at least 0.1 % (1000pm) with at least one of the following:
1) Submit published manufacturer inventory of ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
2) Submit documentation that product has been certified as Cradle-to-Cradle v3 at the Bronze Level or better
3) Submit Declare product label indicating that all ingredients have been disclosed down to 1000 ppm or designated as Red List Free or Declared
4) Living Product Challenge
5) Product Lens Certification
6) USGBC approved program.
b. Material Ingredient Optimization: Submit documentation confirming chemical inventory of products to at least 0.01 % (100pm) and/or that has a compliant material ingredient optimization report with at least one of the following:
1) Submit GreenScreen V1.2 Benchmark: Third party report prepared by a licensed GreenScreen List Translator, or a full GreenScreen Assessment.
2) Submit third-party verified documentation that product has been certified as Cradle-to-Cradle v3 at the Bronze Level or better
3) Submit third-party verified Cradle to Cradle v3 Material Health certificate at the Bronze Level or better
4) Submit third-party verified Declare product label indicating that all ingredients have been disclosed down to 100 ppm
5) Submit third-party verified documentation that product is Living Product Challenge certified with a Red List Free or LBC Red List Free Declare label.
6) Submit documentation that product has a manufacturer prepared action plan with material inventory to at least 1000 ppm.

1.6 CLOSEOUT SUBMITTALS

A. As a condition of project closeout, the Exterior Enclosure System Contractor shall submit the following to the Owner:
1. As-Built Drawings: Submit As-Built drawing of the complete Exterior Enclosure System complying with requirements of Division 01. As-Built drawings shall be based upon the final submission Shop Drawings and shall include site modifications that differ from the final submission Shop Drawing details.
2. Maintenance Manual: Submit Exterior Enclosure System Maintenance Manual covering Assemblies. This shall include:

a. A description of each Cladding System including a set of "As-Built" shop drawings in electronic form.
b. Name and address of the supplier, designer, fabricator and/or installer of each Assembly.
c. Manufacturer of Components; Component serial number; Component Product data sheets; Component Brochures; Component Test Certificates; Component Warranties.
d. List of material finishes. Include Manufacturer identifier of finishes.
e. Warranties
f. Schedule for recommended inspection and testing of Assemblies and/or Components. At a minimum this shall include required inspection and testing prior to expiration of warranties.
g. Recommended service schedule of Components; Manufacturer Service Manuals.
h. Recommended cleaning schedule and methodology compatible with building access system.
i. Maintenance Contracts: As defined in individual Sections of the specifications.
j. Field test reports indicating component tested, applicable standards, description of test, acceptance criteria and interpretation of results, including mode of failure relative to compliance with performance requirements of each component of the exterior enclosure system.

1.7 QUALITY ASSURANCE

A. Installer/Erector Qualifications: Erection firms specializing in the erection of Exterior Enclosure System Assemblies, and who have successfully completed at least five (5) projects similar in design, content, and extent to that required for this project. The work for the referenced projects shall have resulted in construction with a record of successful ins-ervice performance for a period of not less than ten (10) years.
   1. Erection firm's personnel shall be preapproved or trained and certified by specific assembly manufacturers.

B. Fabricator/Fabrication Shop: Engage manufacturers/fabricators with inhouse fabrications shops capable of providing full fabrication of exterior enclosures. Fabrication shop shall be open for quality assurance inspection by the Owner's Independent Inspection Agency, the Owner's Representative, the Commissioning Agent, and the Architect/Engineer. Fabrication shop shall allow full documentation of fabrication shop techniques via photographic and video recording.

C. Professional Engineer Qualifications: A professional engineer qualified to practice in the jurisdiction where Project is located, with five (5) years of successful experience in the in the design, fabrication and installation of the Assemblies for which they will be responsible, who will prepare fabrication engineering and design calculations and supervised the shop drawing process for the project exterior wall. Engineer shall be approved by component and assembly exterior wall manufacturers.

D. Reference Standards: Except as modified by governing codes and by the Contract Documents, comply with the applicable provisions and recommendations of the Codes and Standards included in the individual technical Sections for each element of the Exterior Enclosure System and recommendations of the following. Where standards conflict the more stringent shall apply.
   1. Aluminum Association (AA) http://aluminum.org/:
      a. "Aluminum Standards & Data"
      b. "Aluminum Design Manual"
      c. "Welding Aluminum – Questions and Answers"
      d. "Designation System for Aluminum Finishes," DAF45.
   2. American Architectural Manufacturers Association (AAMA):

a. AAMA, "Metal Curtain Wall Manual."
b. AAMA 501, "Methods of Tests for Exterior Walls."
c. AAMA 501.1, "Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure."
d. AAMA 501.2, "Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems".
e. AAMA 509, "Voluntary Test and Classification Method for Drained and Back Ventilated Rain Screen Wall Cladding Systems".
f. AAMA "Curtain Wall Design Guide Manual," Volumes 19.
g. AAMA, "Installation of Aluminum Curtain Walls."
h. AAMA, "Aluminum Storefront and Entrance Manual."
i. AAMA TIR A3, "Fire Resistive Design Guidelines for Curtain Wall Assemblies."
j. AAMA 611, "Voluntary Specifications for Anodized Architectural Aluminum."
k. AAMA 620, "Voluntary Specification for High Performance Organic Coatings on Coil Coated Architectural Aluminum Substrates."
l. AAMA 621, "Voluntary Specification for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) and Zinc-Aluminum Coated Steel Substrates."
m. AAMA 2603, "Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels."
n. AAMA 2604, "Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels."
o. AAMA 2605, "Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels."

3. National Fenestration Rating Council (NFRC)
   a. NFRC 100, "Procedure for Determining Fenestration Product U-factors"
   b. NFRC 200, "Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence"
   c. NFRC 300, "Test Method for determining the Solar Optical Properties of Glazing Materials and Systems".
   d. NFRC 400, "Procedure for Determining Fenestration Product Air Leakage"
4. American Institute of Steel Construction (AISC):
   a. AISC "Steel Construction Manual," Current Edition.
   b. AISC 303, "Code of Standard Practice for Structural Steel Buildings and Bridges."
   c. AISC 360, "Specification for Structural Steel Buildings."
   d. AISC 303, "Code of Standard Practice for Steel Buildings and Bridges, Section 10. Architectural Exposed Structural Steel."
5. American Iron and Steel Institute
   a. AISI "S1002012: North American Specification for the Design of Cold-Formed Steel Structural Members".
   b. AISI "S2002012: North American Standard for Cold-Formed Steel Framing General Provisions".
   c. AISI "S2022011: Code of Standard Practice for Cold-Formed Steel Structural Framing".
   d. AISI "S2112007 w/S12012 (Reaffirmed 2012): North American Standard for Cold-Formed Steel Framing Wall Stud Design, with Supplement 1".
   e. AISI "S2122007 (Reaffirmed 2012): North American Standard for Cold-Formed Steel Framing Header Design".
   f. AISI "S2132007 w/S12009 (Reaffirmed 2012): North American Standard for Cold-Formed Steel Framing Lateral Design, with Supplement 1".
6. American National Standards Institute
   a. ANSI/IWCA I14.1 "Window Cleaning Safety Standard."

b. ANSI Z97.1 "For Safety Glazing Materials Used in Buildings Safety Performance Specifications and Methods of Test."

7. American Society for Testing and Materials (ASTM):
   a. ASTM C864, "Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers."
   b. ASTM C1401, "Standard Guide for Structural Sealant Glazing."
   c. ASTM E90, "Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements."
   d. ASTM E283, "Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen."
   e. ASTM E331, "Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference".
   f. ASTM E488 "Standard Test Methods for Strength of Anchors in Concrete Elements".
   g. ASTM E783, "Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.
   h. ASTM E1105, "Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference"
   i. ASTM E1186, " Air Leakage Site Detection in Building Envelopes and Air Barrier Systems
   j. ASTM E1300, "Standard Practice for Determining Load Resistance of Glass in Buildings"
   k. ASTM E1886, "Standard Test Method for Performance of Exterior windows, Curtain Walls, Doors and Impact Protective Systems Impacted by missile(s) and exposed to Cyclic Pressure Differentials".
   l. ASTM E1996 Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes.
   m. ASTM E2112, "Standard Practice for Installation of Exterior Windows, Doors and Skylights."
   n. ASTM E2178, "Standard Test Method for Air Permeance of Building Materials."
   o. ASTM E2307, "Standard Test Method for Determining Fire Resistance of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multistory Test Apparatus".
   p. ASTM E2357, “Standard Test Method for Determining Air Leakage Rate of Air Barrier Assemblies”.
   q. ASTM D4541 "Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers".
8. American Welding Society (AWS):
   a. AWS A5.10 "Specification for Aluminum and Aluminum Alloy Bare Welding Rods and Electrodes."
   b. AWS D1.1 "Structural Welding Code, Steel."
   c. AWS D1.2 "Structural Welding Code, Aluminum."
9. Glass Association of North America (GANA):
   a. "Glazing Manual".
   b. "Sealant Manual".
   c. "Protective Glazing Manual".
   d. "Project Managers Reference Manual".
   e. "Laminated Glazing Reference Manual".
   f. "Engineering Standards Manual".
   g. "Fully Tempered Heavy Glass Door and Entrance Systems Design Guide".
   h. "Test Methods / Specifications".

10. Insulating Glass Manufacturer's Association, IGCC/IGMA Certification program for ASTM E2190.
11. National Association of Architectural Metal Manufacturers (NAAMM): NAAMM AMP 500 "Metal Finishes Manual for Architectural and Metal Products."
12. The Society for Protective Coatings (SSPC): "Systems and Specifications: SSPC Painting Manual, Volume 2, 2008 Edition."
13. Sheet Metal and Air Conditioning Contractors National Association, Inc., (SMACNA) "Architectural Sheet Metal Manual," Sixth Edition.
14. Federal Standard 16 CFR 1201, Consumer Product Safety Commission (CPSC): "Safety Standard for Architectural Glazing Materials," as published in the Code of Federal Regulations (CFR). Comply with the applicable requirements of the laws, codes, ordinances and regulations of Federal and Municipal authorities having jurisdiction, wherever requirements conflict the more stringent shall be required. Obtain approvals from all such authorities. As a minimum provide safety glazing complying with ANSI Z97.1 and testing requirements of 16 CFR Part 1201 for Category II materials.

E. Visual Mockups: Provide at Project site where directed visual mockups of the exterior wall for visual review by the Architect, extent indicated on the drawings and as specified in related sections.
1. Standalone visual mockup consisting of the following:
    a. Exterior Enclosure Mock-up will consist of a corner condition of the Pier Building incorporating the Lower-Level CMU assembly, Spandrel Metal panels, upper Pier Level Metal Panel Soffit and Fascia inclusive of coping detail and parapets.
2. Provide mockups as shown on Drawings including supports, attachments, and accessories. Locate mockup at the project site, at a location as selected by client.
3. Install full-scale mockups of assemblies at project site at location acceptable to Owner.
4. Build mockups representative of the finished Work, to verify selections made under sample submittals and to demonstrate aesthetic effects, fit, finish, joinery, and level for craftsmanship and set quality standards for fabrication and installation. Provide joint conditions, anchorage, glass panels, paint finish and other materials and features as will be provided in the final work.
5. Erect visual mockup(s) with tops, sides and back at least 10 ft. deep with access to interior space, so as to allow viewing from interior of mockup assembly. Provide simulated lighting (type and color) with flat ceiling replicating finished construction.
6. Clean mockup with materials and techniques intended for use on the project, before requesting the Architect's review.
7. Allow the Architect full access to fabrication shop including photographic and video access for project documentation purposes.
8. Replace unsatisfactory work to obtain approval of the Architect. Approved mockup shall serve as a standard of workmanship for the project. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
9. Where changes in the work are required as a result of experience gained through the construction of mockup, those changes shall be coordinated with other work and the affected submittals revised at no additional cost to the Owner.
10. In the event the mockup is rejected, remove and replace it at no additional cost to Owner. Removal and replacement shall occur as many times as necessary in order for the mockup to comply with the requirements of the contract documents.
11. Owner will review and carry out a single rereview if required on each initial mockup at Owner's expense. Contractor shall allow for the review and rereview within the Project Schedule. Allow twenty (20) days for Owner's review of each mockup.

F. Sample Assembly: Provide two (2) sample assemblies of curtain wall that is a minimum of 2 feet square and includes a 4way panel joint that can be readily disassembled and assembled. The

functional components of the Sample assembly such as seals, splices and gaskets shall be fabricated exactly as proposed on site.

G. Silicone Structural Glazing: Provide Silicone Structural Glazing Quality Control Manual in accordance with Structural Silicone Manufacturer's requirements. The Silicone Structural Glazing Quality Control Manual shall include the following:
   1. Structural Silicone details approved by the Structural Silicone Manufacturer.
   2. Structural Silicone Manufacturer Project Checklist approval letter(s).
   3. Project substrate and materials descriptions and specifications.
   4. Structural Silicone Manufacturer adhesion and compatibility approval letter(s).
   5. In-house Structural Silicone production and quality control procedures.
   6. Completed sealant production quality control logs with glass test, butterfly test, snap time test and mix ratio test results.
   7. Completed sealant adhesion and cure quality control logs with peel adhesion test dry and wet conditions, H-piece test and deglaze test results.
   8. Traceability documentation which allows each production unit to be precisely correlated to a specific date, time and location of production. All production units must be numbered so that they can be specifically linked to the quality control logs. The position of each panel on the building should be marked on the elevation drawing so that it can be easily identified if required.

1.8 COORDINATION

A. Coordinate Exterior Enclosure System Assembly water barriers and drainage paths, air and vapor barriers, flashing, trim, and construction of structural supports, and adjoining work to provide a complete watertight, airtight, secure, and noncorrosive installation.
   1. Controlled Sections and Related Sections articles in 1.1 define technical sections of work controlled by this Section and related technical sections of work that require coordination for documentation and interface details.

B. Coordinate Exterior Enclosure System with Non-Exterior Enclosure System (including but not limited to foundations and roofs) water barriers and drainage paths, air and vapor barriers, flashing, trim, structural supports, and adjoining work to provide a complete watertight, airtight, secure, and noncorrosive installation.

C. The Exterior Enclosure System Contractor is responsible for coordination and documentation of interface details.

1.9 IDENTIFICATION, DELIVERY, STORAGE AND HANDLING

A. General: Comply with the applicable provisions of references for identification, delivery, storage and handling of assemblies and components.

B. Identification: Clearly mark and identify installation locations on Panels and site installed components. Identification marks shall be not be visible after installation.

C. Packaging: Maintain manufacturers' protective packaging during delivery storage and handling to protect the components from damage, adverse effects that may result from changes in temperature, moisture or other vapor concentrations.

D. Storage: Store components in a location and in a manner to avoid damage to the components. Stack components to prevent bending, excessive pressure, abrasion or other permanent

damage of the Component and its finished surfaces. Store components in a clean, dry location, away from uncured concrete and masonry and other construction activities. Cover with non-staining covering in a manner that will permit circulation of air inside the covering.

E. Keep handling of components to a minimum. Exercise care to avoid damage to finishes of metals.

1.10 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecast weather conditions permit assembly of exterior enclosure components according to manufacturers' written instructions and warranty requirements.

B. Field Measurements: Prior to fabrication of materials take field measurements of structure or substrates to receive enclosure Assemblies.
   1. Verify locations of structural members and Exterior Enclosure System penetrations by taking field measurements before Exterior Enclosure System fabrication. Indicate measurements on Shop Drawings.
   2. Established Dimensions: Where field measurements cannot be made without delaying the Work, either establish framing and opening dimensions and proceed with fabricating exterior enclosures without field measurements or allow for field trimming of panels. Coordinate wall construction to ensure that building dimensions, locations of structural members, and openings correspond to established dimensions.

1.11 WARRANTY

A. Special Warranty: Provide a Workmanship and Weathertightness warranty in a form acceptable to Owner and Architect in which exterior enclosure system Contractor agrees to repair or replace exterior enclosure system assemblies and components as defined in Article 1.1 Summary that fail within the Warranty Period.
   1. Failures include, but are not limited to, the following:
      a. As defined by Article "Performance Requirements”.
      b. Damage of materials and finishes prior to Substantial Completion.
   2. Warranty Period: Five years from date of Substantial Completion.

B. Material Warranties: Provide Manufacturers' material warranties as covered in Controlled Sections and Related Sections.

C. Compile warranties in Maintenance Manual, to include maintenance requirements in Controlled and Related Sections.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Design Criteria: Provide a complete, integrated system of mutually dependent assemblies and components that form the exterior enclosure system capable of withstanding structural loads, dead loads, live loads, thermally induced movement, and exposure to weather without failure, deflection, or infiltration of air and water into building interior beyond specified limits.

B. Prescriptive Requirements
   1. The Exterior Enclosure System, excluding butt glazing, shall have two lines of defense against water intrusion. The outer line shall protect the inner line from the greater majority of water and UV radiation that may strike the System. The inner line shall be an air and water barrier. If a vapor barrier is required, it shall be located at the inner line. The cavity between the inner and outer line shall be vented and drained to the outside and shall have internal baffles to minimize air movement within the cavity.
   2. Pressure Equalized Enclosure Systems shall be utilized on all Unitized Curtain Walls, Stick System Curtain Walls, Cassette Curtain Wall Systems,
   3. For deflections only “Components and Cladding” of systems shall be designed for full wind load pressures with a reduction factor per applicable building code.
   4. Continuity of insulation and continuity of inner and outer lines of defense (including air and water barrier) shall be maintained for the exterior enclosure system. This includes joints and junctions within assemblies, between assemblies and at junction with non-exterior enclosure system assemblies. Joints and junctions shall have at least two lines of defense, with air cavities between drained and vented to the outside.
   5. Fasteners, fixings, brackets and anchors that penetrate or are outside of the air / water barrier shall be stainless steel with thermal brake components.

C. General Performance: Comply with performance requirements specified, without failure due to defective manufacture, fabrication, installation, or other defects in construction.
   1. The Contract Documents establish the design concept for each assembly and component of the exterior building enclosure system by means of the dimensions and profiles of individual units, members, or other components; the arrangement and/or alignment of individual or groups of units, members or other components; and the sight lines, however established. Details indicated are not all-inclusive. Within these parameters, the Contractor is responsible for the design and engineering of the system, including all modifications and additions that may be required to meet the specified requirements and maintain the design concept for the exterior building enclosure system. Additional details as are necessary and reasonably inferable from the details shown and the materials and performance criteria specified shall be the responsibility of the Contractor, as is provision of additional steel brackets, reinforcement and supports may be necessary to support imposed loads.
   2. Critical Dimensions: Use the following critical dimensions without modifications
      a. Wall Assembly Depth: provide a complete wall system as shown and as specified with components and systems located within the area from the exterior face as shown to the face of column, beam or edge of slab shown, without encroachment or displacement of the interior construction and finishes shown.
   3. Assemblies and components, including anchorage, shall withstand or accommodate, without failure, the effects of the following:
      a. Structural and thermal loads.
      b. Air infiltration and water penetration up to specified limits.
      c. Movements of supporting structure as indicated, including, but not limited to, story drift, twist, column shortening, long-term creep, shrinkage, and deflection from uniformly distributed and concentrated live loads, and similar movements.
      d. Dimensional tolerances, including fabrication and installation tolerances, of building frame and other adjacent construction.
   4. Failure includes the following:
      a. Permanent deformation (set) in assembly components under specified loading conditions. Permanent deformation shall be taken as deflection without recovery exceeding 0.2 percent of span, at 1.5times the design load.
      b. Deflections in excess of specified limits.
      c. Twisting (rotation) of the assembly components in excess of 1 degree, measured between ends and center of each Component span.
      d. Thermal stresses transferring to building structure.

e. Glass and other component breakage. Glass failures include but are not limited to thermal fracture under normal operating conditions and nickel sulfide and other inclusion induced "spontaneous" fractures.
f. Noise or vibration created by wind, thermal or structural movements.
g. Water leaks.
h. Air leaks above specified limits.
i. Uncontrolled condensation.
j. Loosening or weakening of fasteners, attachments, and components.
k. Adverse corrosion or weathering of components.
l. Failure of operating units when operated within specified limits.

D. Fabrication Engineering and Design Responsibility: Engage a qualified Professional Engineer , as defined in Section 01 33 16, “Fabrication Engineering Design Data,” to engineer and design and prepare or supervise the preparation of fabrication engineering data for assemblies and components, including drawings, testing program development, test-result interpretation, and comprehensive engineering analysis that shows assemblies' compliance with specified requirements.
1. The Professional Engineer shall demonstrate an experience in the fabrication engineering and design of similar assemblies and components.
2. Engineering analysis to include structural and thermal performance and any other engineering performance requirements specifically included in following sections.
3. Provide signed and sealed structural calculations and Drawings by Professional Engineer registered in the State of Texas.

E. Coordination of Building Enclosure System Subcontracts: Design-Builder shall coordinate interfaces between assembly or component subcontracts. Evidence of this coordination shall be documented and submitted to the Architect for approval. Coordination shall include as a minimum:
1. Clear delineation of each subcontractor's scope.
2. Installation sequence and interface requirements.
3. Evidence of continuity and compatibility between subcontracts for water, air/vapor barriers, insulation and other materials.

F. Structural Loads: Provide Assemblies and Components, including anchorage, capable of withstanding, without failure, the effects of the following cladding design loads within limits and under conditions indicated, in addition to structural loads indicated on Structural Drawings:
1. Risk Category: Risk category III for loads calculated using American Society of Civil Engineers' ASCE 7, "Minimum Design Loads for Buildings and Other Structures".
2. Dead Loads: Determine in accordance with ASCE 7 or Code requirements if more restrictive. Assemblies and Components shall support their own weight and transmit this weight back to the support structure without overload or adverse displacement.
3. Live Loads: ASCE 7 or Code requirements if more restrictive. Assemblies and Components shall resist live loads and transmit these loads back to the support structure without failure of materials or permanent deformation. Live loads to include:
   a. Barriers and Handrails: Not less than the more severe loads
      1) Concentrated load of 200 lbs (0.89 kN) applied in any direction.
      2) Uniform load of 50lbs (0.75 kN/m) in any direction.
      3) Uniform and concentrated loads need not be assumed to act concurrently.
      4) Infill concentrated load: 50 psf load in any direction.
      5) Railings, balusters, infill of guards and components shall withstand wind loads for exterior railings subject to wind loads greater than 50 lbs.
   b. Incidental (Building Occupant) Loads: Internal horizontal, ledges, projections and surfaces greater than 6inch (150 mm) deep and within 10feet (3.0 m) from finished floor level shall be designed for a vertical live load not less than 300 lbs on an area of 4 sq. inches.

c. Maintenance Loads: External horizontal, ledges, projections and surfaces shall be designed for a vertical live load not less than 300 lbs concentrated load.
d. Building Maintenance Access Restraint Loads: Not less than 600 lbf (2.7 kN) applied in any direction.
e. Fall Arrest System Restraint Loads:
1) For Tie-Back Anchors: Not less than 5000 lbs applied in any direction.
2) For horizontal life line stanchions: 7200 lbs ultimate load

4. Snow, Rain and Ice Loads: Determine in accordance with ASCE 7 as adopted, supplemented and amended by the local Building Code. Assemblies and Components shall resist snow, rain and ice loads and transmit these loads back to the support structure without failure of materials or permanent deformation.
5. Seismic Loads: Determine in accordance with ASCE 7 or Code requirements if more restrictive. Assemblies and Components shall resist seismic loads and transmit these loads back to the support structure without failure of materials or permanent deformation unless specifically allowed.
a. Short Period Spectral Acceleration: SS and Damped, spectral response acceleration parameter: SDS. See General Notes on Structural Drawings for requirements for each building.
1) The following components shall be designed based on those values:
a) Wall Elements
b) Body of Wall panel Connections
b. Wind Loads: Components shall resist loads and transmit these loads back to the support structure without failure of materials, performance, and without permanent deformation.
1) Basic wind speed for walls calculated based on 100 mph per ASCE-7-05.
2) Importance Factor: 1.15.
3) Exposure Category: C.
6. Self-Straining and Thermal Loads: Design, fabricate and install assemblies and components to provide for expansion and contraction of the exterior wall, resist self-straining and Thermal loads and transmit these loads back to the support structure without, buckling, sealed joint failure, glass breakage, undue stress on members or anchors, failure of materials or permanent deformation. Use the following design temperature ranges:
a. Absolute Surface Temperature Range: 0 deg F to 180 deg F
b. Temperature Differential: Use a minimum of +/ 67% of the Absolute Surface Temperature Range to calculate thermal expansion/contraction stresses.
c. Shadow Boxes: Shadow boxes shall be destined for an exposed surface metal temperature (including paint coating system) range of 18 F. to +235 F. Provide for venting of shadow box back pan. The metal back panel shall exhibit no distress (buckling or distortion) nor shall fastener failure occur as a result of temperature exposure.

G. Load Combinations: Specified loads shall be combined in accordance with ASCE7 or local Building Code requirements, the more restrictive governing.

H. Load Transfer: Ensure loads transferred between primary building structure and assemblies do not impart any undue stress, cause excessive deflections or inhibit thermal movement of building structure or assemblies. Coordinate with Primary Structure Contractor and Structural Engineer.

I. Movements and Deflections
1. General: Include provisions for shrinkage, creep, axial shortening, differential settlement, and other similar assembly and building movements, including provisions for thermal movements, making allowance for support structure and assembly fabrication and installation tolerances.

a. Assemblies shall not be designed to provide stiffness to the overall building lateral stability. Design fabricate and install assemblies to withstand assembly and building movements and loading deflections, including but not limited to:
   1) Dead Loads.
   2) Live Loads.
   3) Seismic Loads.
   4) Wind Loads.
   5) Thermal Movements.
   6) Building Maintenance Access Restraint Loads.

b. Deformation: Permanent Deformation, weld or fastener failure, component disengagement or breakage shall not occur under loading equal to 1.5 times the design load pressures (positive and negative) specified. Permanent deformation is defined as deflection without recovery exceeding of Framing from deflections shall not exceed 0.2 percent of span at 1.5 times the design load.

2. Structural Support Movements: Provide system assemblies that accommodate structural movements including, but not limited to, sway, twist, column shortening, long term creep, and deflections:
   a. Edge Beam Vertical Deflections:
      1) Superimposed Dead Load (all dead load applied after installation of assemblies):
         a) 1 inch (24mm) at Roof
         b) 1/2 inch (12mm) at Concourse
         c) 1 inch (24mm) at HSS girt framing (vertical direction)
      2) Live Load: Defined as deflections after construction:
         a) +/ 3/8 inch +/(15mm) at Roof
         b) +/ 3/8 inch +/(15mm) at Concourse
      3) Total Load: Defined as the max total vertical combination of service level loads:
         a) 2 inch (48mm) at Roof
         b) 3/4 inch (18mm) at Concourse
         c) 1 inch (24mm) at HSS girt framing (vertical direction)
   b. Girt Member Lateral Deflections
      1) Wind Loading: +/ 1” at 50psf specified blast pressure per DFW criteria.
   c. Seismic Inter-story Drift: H/67, where H is the height for any given floor, and no glass will fall from framing under seismic events, taking into consideration a 1.25 importance factor.
      1) For Serviceability requirements, engineer system to accommodate a design factor of H/67*0.3 of the maximum seismic movement
   d. Wind Inter-story Drift: H/400, where H is the height for any given floor.
   e. Column Shortening:
      1) Creep (post installation of Assembly Component): 1/1000inch shortening per 1 inch of concrete column height.

3. Deflection of Framing Members and System Components: Base calculations for the following deflections upon the combination of maximum applied loads, building deflections, thermal stresses, and erection tolerances:
   a. Deflection Normal to Wall Plane:
      1) Glass Supports: Limited to L/175 of clear span (L) for spans up to 13feet 6inches (4.1 m) and to L/240 of clear span plus 1/4inch (6.35 mm) for spans greater than 13feet 6inches (4.1 m) or an amount that restricts edge deflection of individual glazing lites to 3/4inch (19 mm), whichever is less.
         a) Center of glass: Limited to L/60 of clear span (L, use shorter span if 4 edges supported) or to 1inch (25 mm), whichever is less.
         b) Center of non-glass elements: Limited to L/90 of clear span (L, use shorter span if 4 edges supported) or to 3/4inch (19 mm), whichever is less.

c) Back Pan L/60 or 1 inch
d) Tensioned cable: Normal to plan L/85 or as required to conform to allowable glass stresses, whichever is less.

2) Brittle Material Supports (other than Glass), stone and brick: Span/500
a) Brick: Span/600
b) Stone: Span/600

3) Cold Formed Metal Framing: minimum span/240 (greater based on acceptable deflections of items to be supported).

4) Metal Panels L/240 or 3/4 inch

b. Deflection Parallel to Glazing Plane: Limited to L/360 of clear span (L) or 1/8inch (3.2 mm), whichever is less.

c. For Cantilevers: Deflection at full wind pressure (for example at parapets, or framing members overhanging anchor points) shall not exceed 1 % of the cantilever length L/175 or 3/4 inch, whichever is less.

4. Thermal Movements: Provide Assemblies and Components, including anchorages, which accommodate thermal movements within each Assembly and between each Assembly and its supporting elements. Professional Engineer to calculate design thermal movements. Differential Temperatures for expansion and contraction shall be in accordance with Paragraph "Self-Straining and Thermal Loads".

5. Moisture Movements: Provide Assemblies and Components, including anchorages, which accommodate moisture movement within each Assembly and between each Assembly and their supporting elements and direct moisture out of the exterior wall system using two lines of defense.

6. Building Movement/Expansion Joints (Seismic/Wind/Thermal): Provide Assemblies and Components, including anchorages, which accommodate Building Movement Joints (seismic, thermal, wind movements etc.). Building Movement Joints shall be designed to meet minimum envelope performance requirements specified for the design movements as listed below:

a. At Concourse Level:

1) Plan: In-Plane: +/ 1 inch.
2) Plan: Out-of-Plane: +/ 1 inch.
3) Level: See deflection criteria in structural documents.

b. At Roof Level:

1) Plan: In-Plane: +/ 2 inch.
2) Plan: Out-of-Plane: +/ 2 inch.
3) Level: See deflection criteria in structural documents.

7. Anchorage:

a. Anchorage disengagement or breakage shall not occur when an installed unit is subjected to a force equal to 2.5 times the design load

b. Anchorage shall be properly braced in three orthogonal directions (vertical, transvers, and longitudinal) to resist specified loadings from any direction (both positive and negative pressure).

c. Anchors and supports shall be designed to accommodate all loads and movements of the enclosure system to the building structure. Anchor design to be closely coordinated and confirmed by Building Engineer and located so as to allow a uniform distribution of anticipated wind loads and shall not impart unauthorized torsional loading to spandrel beams, cause excessive stress on the structure, cause excessive deflection, inhibit thermal movement or conflict with clearances for equipment. Eccentric loads imposed into the building structural elements by the exterior wall anchorage are not allowed. Eccentric loads created by anchorage of exterior wall shall be neutralized by addition of bracing or other means.

J. Structural Support Dimensional Tolerances: Provide Assemblies, including anchorage, that accommodate structural support dimensional tolerances of building frame and other adjacent construction as shown on structural drawings.

K. Flatwork Tolerances: Metal panels, fascia's, sills and other sheet or plate fabricated items shall be flat, free of bow, oil canning" or "read through" of stiffeners, welds. Exposed metal faces shall be flat with maximum uniform bow in 2 ft. not to exceed 1/32 inch and maximum overall variation in plane between high and low points within a panel not to exceed 1/16 inch.

L. Design Temperatures for Mechanical Systems: Design Assemblies and Components to accommodate:
1. Minimum External Temperature: 20 deg F (7deg C)
2. Maximum External Temperature: 105 deg F (41 deg C).
3. Internal Temperatures:
    a. Winter: 70 +/ 5 deg F (21 +/ 3 deg C).
    b. Summer: 72 +/ 5 deg F (21 +/ 3 deg C)

M. Design Internal Relative Humidity: Design Assemblies and Components to accommodate:
1. Internal Relative Humidity: Internal humidity is uncontrolled. For condensation risk assessments, assume 50% relative humidity during heating periods.

N. Condensation Control: No uncontrolled condensation inside of the vapor barrier, or air and water barriers acceptable for external temperatures above the Condensation Design External Heating Temperature and/or Condensation Design Internal Heating Temperature conditions
1. Condensation Design External Heating Temperature: ASHRAE Fundamentals 99.6% Heating Dry Bulb temperature 12.9 deg F, but not greater than the minimum specified exterior design temperature.
2. Condensation Design Internal Heating Temperature and Humidity: 70 deg F and the specified "Design Internal Relative Humidity" for internal spaces not actively humidified.
3. Exterior Enclosure Systems: The exterior enclosure systems shall be designed to prevent condensation on all interior surfaces under the following conditions:
    a. Outdoor ambient air temperature: 8 F
    b. Mean wind speed: 12.3 mph
    c. Indoor ambient air temperature: 70 F
    d. Indoor relative humidity: 50%

O. Weatherproofing: Provide assemblies, junctions between different assemblies and junctions between assemblies and non-exterior enclosure systems including but not limited to roofs, , that are weatherproof against air infiltration/exfiltration, water penetration and condensation formation:
1. Barriers: Unless specifically detailed to the contrary, the air and water barrier shall function as a Water Barrier and a Vapor Barrier. Barrier systems shall be durable, materially compatible and able to accommodate design building movements.
2. Vapor Barriers: All vapor barrier shall have a permeance of less than 0.6 perms.
3. Air Infiltration/Exfiltration: Assemblies shall be constructed and sealed to create an air and water barrier to limit air infiltration/exfiltration. This includes sealing of all penetrations through the Air and Water Barrier. All seals shall allow for design movements. Maximum air infiltration limits are as follows:
    a. Curtain Wall, Storefront Glazing and Doors:
        1) Curtain Wall and Storefront Glazing: 0.06 cubic foot per minute per square foot (5.5 m3/h/m2) at 6.24 pounds per square foot (75 Pa) in accordance with ASTM E283.
        2) Glazed Swinging Commercial Entrance Doors and Revolving Doors: 1.00 cfm/sq ft (18.3 m3/h/m2) at 1.57 pounds per square foot (75 Pa) in accordance with ASTM E283.

3) Swinging Door Assemblies above Grade: 0.2 cfm per square foot (2.6 L/s/m2), at 1.57 pounds per square foot (75 Pa) when tested according to NFRC 400 or AAMA/WDMA/ CSA 101/I.S.2/A440 by an accredited, independent laboratory and listed and labeled by the manufacturer.

b. Opaque Assemblies:
1) Air leakage less than 0.004 cfm/sqft under a pressure differential of 1.57 psf (75 Pa) when tested in accordance with ASTM E2178, and ASTM E2357 for air and water barrier assemblies.
2) Overall Assembly Performance: For Assemblies other than Curtain Wall, Storefront Glazing and Doors, each Other Assembly (including junctions with adjoining Assemblies) shall have an air leakage such that the sum of the area weighted air leakage of Assemblies (including Curtain Wall, Storefront Glazing, Doors, roofs and basements) results in an overall building air leakage of no more than 0.25 cfm/sq ft at 1.57 psf as per ASTM Standard E779.
3) Swinging solid entrance door assemblies: Coordinate with Division 08 Sections 08 11 13 "Hollow Metal Doors and Frames" and "Stainless Steel Doors and Frame" to provide assemblies that have been fabricated according to tested assemblies to provide a maximum air leakage of 0.3 cfm at 6.24 psf air pressure in compliance with WDMA/CSA 101/I.S.2/A440.

4. Water Penetration: No uncontrolled water shall penetrate assemblies. Any amount of water inside the air/vapor barrier shall be considered as uncontrolled water. Uncontrolled water may be detected visually; by feel or by the use of a probe (e.g. piece of paper). Specifically, water, other than from condensation that collects in a condensation gutter, is considered as uncontrolled water. Water leakage does not include water controlled by flashing and gutters outside of the water barrier that is drained to the exterior.
5. Venting and Draining Openings: All vent and drain holes, slots and openings shall be baffled against direct rain water entry.
6. Continuity with Non-Exterior Enclosure Systems: Exterior Enclosure System Contractor shall coordinate with and be responsible for engineering, developing details and executing systems to maintain continuity with Non-Exterior Enclosure Systems to comply with weatherproofing performance requirements.

P. Energy Performance:
1. Exterior Enclosure System shall meet the following energy performance requirements:
a. Overall Thermal Transmittance (U-factor), including frame and edge of glass effects and adjustment for insulated glazing in off-vertical applications, as determined according to NFRC 100, of not more than:
1) Aluminum Framed glazing 0.50 Btu/HR/sqft x h x deg F per RPW.
b. Center of Panel Value for Aluminum Framed Spandrel: 0.0.64 Btu/HR/sqft x h x deg F per RPW.
c. Other Solid (Opaque) Wall Assemblies: 0.0.48 Btu/HR/sqft x h x deg F per RPW.
d. Aluminum framed assemblies shall have certified and labeled energy performance ratings in accordance with NFRC and AAMA accredited testing laboratories.
e. Solar Heat Gain Coefficient: Fixed and operable glazing and framing areas shall have a solar heat gain coefficient as determined according to NFRC 200 of no greater than:
1) Wall Glazing: 0.36 per RPW.
2) Insulated glazing unit assemblies. Refer to Division 08, Section 08 80 00 "Glazing"
f. Assemblies shall also comply with Paragraph "Condensation Control" performance requirements.

Q. Reflectance Performance: Exterior Enclosure System shall comply with the following reflectance performance requirements:

1. External Exterior Enclosure System surfaces shall comply with Local Building Authority and FAA requirements.

R. Acoustic and Vibration Performance: Exterior Enclosure System shall meet the following acoustic and vibration performance requirements:
   1. Sound Transmission: Provide Exterior Enclosure System, including all Assemblies and junctions between Assemblies, having the following sound-transmission characteristics:
      a. Outdoor-Indoor Transmission Class (OITC): Minimum 26 when tested for laboratory sound transmission loss according to ASTM E90 and determined by ASTM E1332.
   2. Induced Noise: Provide exterior enclosure system, including assemblies and junctions between assemblies, that has no induced noise such as creaks, rattles, whistles, organ piping and the like, resulting from:
      a. Thermal expansion and contraction.
      b. Building movements.
      c. Wind and other air movements.
      d. Plant and equipment operation.
   3. Vibration Control: Provide exterior enclosure system, including assemblies and junctions between assemblies, that has no induced vibrations resulting from:
      a. Wind and other air movements.
      b. Plant and equipment operation.
   4. Anchors, Brackets and Fixings: Anchors, brackets and fixings shall be installed in a manner that prevents any loosing due to vibrations or other cyclic actions such as thermal variation.

S. Fire, Smoke and Draft Barrier: Exterior Enclosure System shall meet the following fire resistance requirements:
   1. Fire, Smoke and Draft Barrier: Provide a continuous fire/smoke/draft barrier as an integral component of the exterior wall systems to prevent the passage of air, flame and smoke from one floor to another, within the exterior wall work.
   2. Fire Rating: Provide exterior enclosure system, including assemblies and components that comply with building code and other local regulatory authorities having jurisdiction, including testing and certification for fire rating requirements.
   3. Exterior Wall / Floor Intersection Fire Resistive Joint System, Smoke and Fire separation: Design the barrier system to accept floor fire safing as an integral part of the system, in compliance with the more stringent requirements of the Building Code or Building Code Section 713.4 including testing to ASTM E119 or ASTM E2307 as specified in Division 07 Section 07 84 46 "Fire-Resistive Joint Firestopping"
      a. Design the barrier to sustain impact from fire hose stream in accordance with requirements of authorities having jurisdiction.
   4. Protection and fire rating of building walls and overhangs adjacent to aircraft fuel pipeline surge suppressors shall be in accordance with NFPA 30 and shall be designed to have a fire rating depending on their distance “d” as a radius from the surge suppressor as follows:
      a. “d” is greater than 25 feet: Fire rating shall be 0.
      b. “d” is greater than 10 feet but less than 25 feet: Fire rating shall be 2 hours.
      c. “d” is less than 10 feet: Fire rating shall be equal to 4 hours.

T. Corrosion Resistance: Provide components that are corrosion resistant:
   1. Provide materials outside of the weather line that are stainless steel.
   2. Prevent galvanic corrosion. Unless accompanied by supporting technical documentation, this shall be achieved by electrically isolating dissimilar metals.

U. Chemical Compatibility: Provide materials that are chemically compatible with each other such that there are no adverse chemical interactions that may discolor and/or degrade the performance of any materials that may come into close proximity to each other.

V. Maintenance and Replacement Capacity: Provide assemblies that can physically be maintained and replaced

W. Infestation: Provide assemblies that minimize the risk of infestation by plants or animals:
1. Provide openings such as vents and drain slots wider than 1/2inch (12 mm) wide with stainless steel insect mesh or other barrier approved by the Architect.
2. Select materials to eliminate or minimize risk of mold and other organic growth.

X. Lightning Protection: Refer to Division 26 for lightning protection requirements.

Y. LEED specific Requirements: Provide material that complies with requirements specified in Division 01, Section 01 81 13 "Sustainable Design Requirements".

2.2 MANUFACTURERS, FABRICATORS AND ERECTORS

A. Manufacturers, Fabricators and Erectors: Acceptable Exterior Enclosure System Assembly Manufacturers, Fabricators and Erectors including but not limited to the following:
1. Permasteelisa
2. Benson
3. Enclos
4. Integro Building Systems
5. Gartner (specialty glazing)
6. Seele (specialty glazing)
7. Roschmann Group (specialty glazing)
8. Frener & Reifier (specialty glazing)
9. Sota (W & W in NYC)
10. EFCO
11. YKK AP.
12. Oldcastle Building Envelope (OBE); CRH Americas
13. U.S. Aluminum, a brand of C.R. Laurence.
14. Graham Architectural Products Corporation.
15. Bunting Architectural Metals.
16. Schuco
17. Wausau Window and Wall Systems; Apogee Wausau Group, Inc.
18. Kawneer
19. United Architectural Metals
20. Bruce Wall Systems
21. Tubelite Inc.

B. Manufacturers and products for exterior wall components and other exterior enclosure systems are specified in other controlled sections.

C. Exterior Wall Types:
1. As shown on drawings and as follows:
   a. **EWS-01A**: Unitized Glazed Aluminum Curtain Wall:
      1) Thermally broken framing system with 10.5 inch depth with structural silicone vertical joints and horizontal vertical gaskets with caps.
      2) Electronically controlled switchable insulated glass units **GL-01**.
      3) Gravity loaded mullion anchors.
   b. **EWS-01B**: Unitized Glazed Aluminum Curtain Wall:

1) Thermally broken framing system with 10.5 inch depth with structural silicone vertical joints and horizontal vertical gaskets with caps.
2) Aluminum bent plate spandrel panels **MTP-05**.
3) Thermal insulation behind spandrel panel,
4) Gravity loaded mullion anchors.

c. **EWS-01C**: Unitized Glazed Aluminum Curtain Wall:
1) Thermally broken framing system with 10.5 inch depth with structural silicone vertical joints and horizontal vertical gaskets with caps.
2) Insulated glass unit **GL-03**.
3) Gravity loaded mullion anchors.

d. **EWS-02A**: Field Glazed Aluminum Curtain Wall:
1) Thermally broken framing system with 6.5 inch depth with structural silicone.
2) 4-sided toggle glazed system, SS (screw spline) outside glazed with recessed glass edge spacer with shop applied metal interface with interior caps.
3) Insulated glass units **GL-02**.
4) Gravity loaded flat concrete slab.

e. **EWS-02B**: Field Glazed Aluminum Curtain Wall:
1) Thermally broken framing system with 6.5 inch depth with structural silicone.
2) 4-sided toggle glazed system, SS (screw spline) outside glazed with recessed glass edge spacer with shop applied metal interface with interior caps.
3) Aluminum bent plate spandrel panels **MTP-06**.
4) Thermal insulation behind spandrel panel.
5) Gravity loaded flat concrete slab.

f. **EWS-03:**
1) Existing aluminum-framed exterior storefront system.
2) Aluminum bent plate spandrel panels **MTP-07.**
3) Thermal insulation behind spandrel.

g. **EWS-11**:
1) 8inch **CMU-02** veneer.
2) Air and water barrier **AB-02.**
3) 1-1/2 inch Mineral Wool Insulation **INS-01.**
4) Air cavity.
5) 4 inch **CMU-03** structural backup.

h. **EWS-12**:
1) Cold formed metal framing,
2) 5/8” Exterior sheathing,
3) Air and water barrier **AB-02.**
4) 4 inch mineral wool insulation **INS-01.**
5) Air cavity.
6) Aluminum plate panels **MTP-01.**

i. **EWS-14**:
1) Concrete Slab
2) Spray Thermal Insulation **INS-03**

j. **EWS-15**:
1) 8 inch Concrete Masonry Unit **CMU-01**

k. Aluminum bent plate spandrel panels **MTP-08** at existing glazed aluminum curtain wall.

D. Single Source: Each Assembly type shall be single sourced. Each assembly shall be designed, engineered, fabricated and installed by a single responsible contracting entity that assumes single source responsibility for the integrity of the exterior wall assembly. A single entity will be engaged to provide overall responsibility for interfaces between systems. In absence of a single source for the interface, the Design-Builder assumes full responsibility for the exterior wall

assembly, including fabrication engineering and design, coordination and transitions between systems, installation, performance of exterior wall enclosures

2.3 MATERIALS, COMPONENTS AND ASSEMBLIES

A. General: Provide materials and equipment that are of good quality and new, unless otherwise specified, are free from faults and defects not inherent in the quality required, that conform with requirements of Contract Documents, that are suitable for use and function intended, that are corresponding in quality to related materials in the absence of a complete specification, that are of quality appearance where exposed to view, that are of one manufacturer or source for the same specific purpose, with uniform appearance and physical properties, and that are identical and interchangeable when required in quantity.
   1. Provide assemblies and components, complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.

B. Recycled Content of Products: Provide products with an average recycled content of products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than percentages listed below
   1. Aluminum: 12 percent
   2. Steel: 50 percent
   3. Decorative Metals: 25 percent

C. Regional Materials: Provide submittal indicating location where building materials (by cost) that were regionally extracted, processed and manufactured and distance to the Project Site in miles.

D. Aluminum: Structural Quality Aluminum, Alloy 6061T6, Alloy 6063T5, or Alloy 6063T6.
   1. Extruded Aluminum Bars, Rods, Profiles, and Tubes: ASTM B221
   2. Extruded Structural Pipe and Tubes: ASTM B429.
   3. Structural Profiles: ASTM B308.
   4. Sheet and Plate: ASTM B209.

E. Stainless Steel: Type 316/316L for exterior applications, and type 304/304L for interior applications unless otherwise noted.

F. Tracks and Tie-In Buttons: Fabricated from structural Quality Aluminum extrusions. Fabricate to comply with Local Standards for Window Cleaning and Scaffolding.
   1. Provide internal tracks with 3/4-inch minimum opening, with a minimum 3/4 inch clear on each side of the opening, and a minimum clear depth of 13/4 inch. Track design shall incorporate a method for unencumbered insertion and removal of the engagement device.
   2. Fabricate tie in buttons of proper length, or properly adjustable to serve the function of securing wire rope for window cleaning.
   3. Joints in building tie-in guides shall be mechanically aligned to prevent interference with the proper functioning of the equipment guide assemblies. Joint openings should be limited to 3/4 inch maximum.

G. Steel Reinforcement: ASTM A36 for structural shapes, plates, and bars; ASTM A611 for cold-rolled sheet and strip; or ASTM A570 for hot-rolled sheet and strip.

H. Entrance Doors and Frames: As specified in Division 08, Section 08 41 13 "Aluminum-Framed Entrances and Storefronts".

I. Door Hardware: As specified in Division 08, Section 08 71 00 "Door Hardware."

J. Aluminum panels are specified in Division 07, Sections 07 42 16 " Metal Plate Wall Panels".

K. Sealants and joint fillers for joints within exterior wall systems as specified in Division 07, Section 07 92 00 "Joint Sealants".

L. Flashings: Stainless steel as specified in Division 07, Section 07 62 00 “Sheet Metal Flashing and Trim",

M. Copings: Aluminum copings as specified in Division 08, Section 07 72 00 “Roof Accessories".

N. Thermal Isolators: Where indicated provide rigid Polyamide, EPDM or Silicone isolators of profile and hardness as recommended by the curtain wall fabricator and fabricated to a cross sectional profile to interlock with aluminum extrusions for isolation of exterior glazing frame snap caps and pressure bars to interior glazing frame.

O. Slip and Separator Gaskets:
   1. Bolted slip-joints: Nonmetallic, low friction material bearing temperature and moisture resistances and low abrasion properties as required to suit performance criteria.
   2. Non-bolted slip-joints: Noncorrosive, nontoxic impregnated felt, or butyl, tape with a pressure sensitive adhesive on one surface which is formulated for proper adhesion to metals shown; gasket shall bear temperature and moisture resistance properties as required to suit performance criteria; thickness and width as required.

P. Baffle Material: PVC-coated SIF-G Industrial Foam; UFP Technologies, or equal from HO Technologies. Baffle material shall be provided with a pore count (ppi) as required by assembly fabricator.

Q. Insulating Materials: As specified in Division 07, Section 07 21 00 "Thermal Insulation."

R. Fire Safing Insulation: AS specified in Division 07, Section 07 84 46"Fire-Resistive Joint Firestopping".

S. Louvers: As specified in Division 08 Section 08 91 19 "Fixed Louvers".

2.4 ACCESSORIES

A. Brackets and Reinforcements: Provide manufacturer's standard galvanized steel brackets and reinforcements. Provide non-staining, nonferrous shims for aligning system components.

B. Fasteners and Accessories: Concealed stainless-steel fasteners. At movement joints, use slip-joint linings, spacers, and sleeves of material and type recommended by manufacturer.

C. Anchors: 3way aluminum adjustable anchors that accommodate fabrication and installation tolerances.
   1. Anchors, brackets and fixings that penetrate the air and water barrier shall be stainless steel.

D. Concrete and Masonry Inserts: Stainless steel or hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123 or ASTM A153 requirements.

2.5 HARDWARE

A. General: Coordinate supply and installation of hardware fabricated for each of the Assemblies comprising the Exterior Enclosure System.

B. Hardware Installation: For Hardware not installed in the work of Exterior Enclosure Systems, coordinate with Hardware supplied by other Contractors including but not limited to:
   1. Lighting such as Architectural Lighting and Aircraft Warning Lighting.
   2. Lightning protection systems.
   3. Handrails and other attachments.
   4. CCTV systems.
   5. Photovoltaic Panels.
   6. Building Maintenance Unit restraint anchors.
   7. Sunshade, Louver and Blind systems including motors and controls.
   8. Sensors.
   9. Hose bibs, water hydrants, Siamese connections (combination standpipe and sprinkler system).
   10. Gas vents.
   11. Generator exhaust vents.
   12. Drain and Overflow pipes.
   13. Fuel oil fill pipes.
   14. Signage

2.6 FABRICATION

A. General: Coordinate fabrication to produce a complete Exterior Enclosure System which meets or exceeds the specified performance requirements. To the greatest extent possible, provide for complete fabrication, assembly, finishing, hardware applications and other work before shipment to Project site.

B. Fabricate components that, when assembled, will have accurately fitted joints with ends coped or mitered to produce hairline joints. After fabrication, clearly mark components to identify their locations in Project according to final Shop Drawings.

C. Fabricate components to drain water passing joints, condensation occurring in channeled insulation, condensation occurring within framing members, and moisture migrating within the system to the exterior.

D. Exposed Fasteners: Not permitted.

E. Protection of Metals: Separate dissimilar metals with a coating of bituminous paint, or separation gaskets as the condition requires. Separate aluminum from concrete surfaces with a coating bituminous paint, or separation gaskets as the condition requires.

F. Welding: Weld components to comply with References and final Shop Drawings. Weld before finishing components. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
   1. Comply with relevant weld inspection and testing requirements in Division 05 Structural Steel sections for steel supporting exterior wall components.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer/Erector present, for compliance with requirements for erection tolerances, Exterior Enclosure System supports, and other conditions affecting performance of work.
   1. Before beginning erection of Assemblies and Components, examine each part of the building structural frame indicated to support the Exterior Enclosure System. Notify the Architect, The Owner's Representative, Construction Manager, Commissioning Agent in writing, of any dimensions or conditions, found which will prevent the proper execution of the Work, including specified tolerances. Use designated offset lines and bench marks as basis of measurements.
   2. Examine backup systems to verify that joints are supported by framing or blocking, that joints are sealed for weather resistance, and that installation is within flatness tolerances required by Exterior Enclosure System Contractor.

B. Examine and verify actual locations of Hardware requiring penetrations through Exterior Enclosure System as listed in Paragraph "Hardware; Hardware Installation". Where this Hardware does not align, resolve alignment with the Hardware Contractor and Construction Manager prior to installation of the Exterior Enclosure System.

C. Existing Condition Survey: Engage a professional surveyor to locate position of existing support structure. Provide copies of survey to fabricators.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

E. Commencement of installation shall constitute acceptance of substrate conditions by the Exterior Enclosure System Contractor.

3.2 PREPARATION

A. Prepare substrates prior to installation of Exterior Enclosure System as required by Related Sections.

B. Clean substrates of substances harmful to Components, including removing projections capable of interfering with attachment.

C. Install flashings and other sheet metal to comply with requirements specified in Division 07, Section 07 62 00 "Sheet Metal Flashing and Trim”

D. Install fascia and copings to comply with requirements specified in Division 07, Section 07 72 00 "Roof Accessories".

E. Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous wall panel support members and anchorage according to ASTM C754 and exterior enclosure manufacturer's written recommendations.

F. Soffit Framing: Comply with Division 07, Section 07 42 16 "Metal Plate Wall Panels". Clip furring channels to supports.

3.3 INSTALLATION AND ERECTION

A. Components of the exterior enclosure system shall be assembled, secured, anchored, reinforced, and sealed against air and water infiltration in a manner that will not restrict thermal or load induced movements of the system or the building. Free and silent movement of system components under induced loads shall be achieved.

B. Comply with manufacturer's written instructions for protecting, handling, and installing the Exterior Enclosure System.
   1. Do not install damaged components.
   2. Unless otherwise indicated, fit joints to produce hairline joints free of burrs and distortions.
   3. Rigidly secure nonmovement joints.
   4. Seal joints weathertight, unless otherwise indicated.
   5. Provide water drainable components to direct water to the exterior.

C. Erect components of the Exterior Enclosure System in accordance with the manufacturer's written instructions and recommendations.
   1. Cut and trim Components of the Exterior Enclosure System during erection only with the approval of the manufacturer or fabricator, and only in accordance with its recommendations. Restore finish completely and remove all evidence of cutting and trimming. Remove and replace members where cutting and trimming has impaired strength or appearance.
   2. Set components within the erection tolerances with uniform joints. Place components on aluminum or stainless-steel shims and fasten to supporting substrates using bolts and similar fasteners.
   3. Do not erect components which are warped, deformed, bowed, defaced or otherwise damaged as to impair strength. Remove and replace members damaged in the process of erection.
   4. Coat concealed surfaces of dissimilar material and ferrous metal components with a dielectric separator or other separation in accordance with manufacturer's recommendations.
   5. Install components to drain to the exterior any water passing joints, condensation occurring outside of the weather line, and moisture migrating within the system.

3.4 ERECTION TOLERANCES

A. Shim and align Exterior Enclosure System Assemblies and Components to accommodate the dimensional tolerances of the building structural frame while providing the following as installed tolerances.
   1. Variation from theoretical calculated position as located in plan or elevation in relation to established floors lines, column lines and other fixed elements of the structure, including variations from plumb, level, straight and member size the smaller of:
      a. Plus or minus 1/8inch maximum in any or 10foot (6 mm in 6 m) noncumulative;
      b. 1/8inch (3 mm) per column-to-column bay, or 20 ft., noncumulative.
      c. 1/8inch (3 mm) per floor-to-floor height, noncumulative.
   2. Variation from angle, or plumb, shown: Plus or minus 1/8inch in 10foot (3 mm in 3 m) maximum per run or story height, noncumulative.
   3. Variation from slope, or level, indicated: The smaller of:
      a. Plus or minus 1/4inch maximum in any 20foot (6 mm in 6 m) noncumulative;
      b. 1/4inch (6 mm) per column-to-column bay, noncumulative.
      c. 1/4inch (6 mm) per floor-to-floor height, noncumulative.
   4. In addition to the above erection tolerances, alignment tolerances shall be less than the following:
      a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/4 inch (6 mm) wide, limit offset from true alignment to 1/16 inch (1.5 mm).

b. Where surfaces are separated by reveal or protruding element from 1/4 to 1/2 inch (6 to 12.5 mm) wide, limit offset from true alignment to 1/16 inch (3. mm).
c. Where surfaces are separated by reveal or protruding element of 3/8 inch (9 mm) wide or more, limit offset from true alignment to 1/4 inch (6 mm).

5. Warping: Limit variation from plane to 1/16 inch in 12 feet (1.5 mm in 3.7 m) up to a maximum total variation of 1/4 inch (6 mm) per panel or joint/reveal module.

3.5 ANCHORAGE

A. Anchorage of Exterior Enclosure System Assemblies and Components to the building structure shall be in accordance with the final Shop Drawings.

3.6 WELDING

A. Weld with electrodes and by methods recommended by manufacturer of material being welded, and in accordance with AWS D1.2 for aluminum and AWS D1.1 for concealed steel members. Use only methods which will avoid distortion of exposed faces. Include Stainless steel welding.

B. Welds and adjacent metal areas shall be thoroughly cleaned and coated with a single coat of bituminous paint.

C. Comply with relevant weld inspection and testing requirements in Division 5 Structural Steel Sections for steel supporting exterior wall components.

3.7 SEALING COMPONENTS

A. Sealing Components: Apply sealant and gasket Components in accordance with each component manufacturer's instructions. Before applying components remove mortar, dust, dirt, moisture, and other foreign matter. Mask adjoining exposed surfaces to avoid spilling, dripping, dropping or other unintended contact of the sealing components onto adjacent exposed surfaces.

B. Comply with the requirements specified in Division 07, Section 07 92 00 "Joint Sealants."

3.8 FIELD APPLIED INSULATION AND SAFING

A. Exterior Wall Building Insulation and Safing: Comply with the requirements specified in Division 07, Section 07 21 00 "Thermal Insulation" and Division 07, Section 07 84 46 "Fire-Resistive Joint Firestopping".

1. Clean debris from behind Assemblies during erection and provide temporary closures to prevent further accumulation of debris.
2. Install Fire Safing to comply with local authorities having jurisdictions and AAMA TIR A3 "Fire Resistive Design Guidelines for Curtain Wall Assemblies."
3. Secure Fire Safing with anchored metal flanges or make equivalent provisions to prevent dislocation.

3.9 FIELD QUALITY CONTROL

A. Inspections: Owner will engage a qualified independent inspecting agency to witness field tests and inspections and prepare test reports.

B. Field Testing: Test representative areas to determine compliance of installed Exterior Enclosure System with specified requirements. Do not proceed with installation of the next area until test results for previously completed areas show compliance with requirements.
   1. Carry out testing under the direct supervision of testing and inspection agency personnel.
   2. Field testing shall be witnessed by the Exterior Enclosure System Fabricator/Installer, testing and inspection agency personnel and exterior enclosure product manufacturers' field representatives, the Owner's Representatives, the Architect, the Construction Manager, and the Commissioning Agent.
   3. In the event testing shows the installed work is deficient or does not meet specified performance or testing requirements, remove and replace assemblies at no cost to the Owner. Pay for retesting necessary to demonstrate products and assemblies comply with the specified requirements.
   4. Provide photographic and video documentation of test. Record test data results and submit reports and photographic documentation of tests to Architect for review and acceptance.
   5. Anchor Pull Testing: Perform the following site testing of the exterior wall embedded anchors at times appropriate to the construction schedule and in compliance with ASTM E488, and as directed by the Architect and the Owner's independent testing agency:
      a. Embedded Anchor Testing: Verify the adequacy of the embedded anchorage by means of pull out testing on in situ anchors. Loading for the testing shall be 100% of design load. Number of tests shall be as determined by the Architect but shall not be less than 5% of the total. Location of embed to be tested shall be as selected by Architect. Failure of embed shall require further testing to ascertain the extent of the problem. Amount of additional testing shall be as determined by the Architect.
   6. Structural-Sealant Compatibility and Adhesion: Test structural sealant according to recommendations in ASTM C1401.
      a. Destructive test method, Method A, Hand Pull Tab (Destructive) in ASTM C1401, Appendix X2 shall be used.
         1) A minimum of six areas on each building face shall be tested.
         2) Repair installation areas damaged by testing.
   7. Structural-Sealant Glazing Inspection: After completion of installation, structural-sealant glazing shall be inspected and evaluated according to ASTM C1401 recommendations.
   8. Building maintenance equipment stabilization anchor tests: Perform concentrated and overloaded load tests on building maintenance system tracks and tie-in buttons, to comply with Window Washing Reference Standards.
      a. In addition to loading track anchors and tie-in buttons according to laboratory pull out test loads specified in Part 1 of this Section, apply specified load outward (normal to wall plane) for minimum 5 minutes combined with inward uniform static pressure of 10 psf. Repeat load tests using outward uniform static pressure of 5 psf.
      b. Apply specified load sideways (parallel to wall plane) in 4 directions (left, right, up, down) for minimum 5 minutes, combined with inward and outward uniform static pressure of 10 psf. Repeat load tests using outward uniform static pressure of 10 psf.
      c. At the completion of the test, track system and tie-in buttons shall show no evidence of failure or permanent deformation of either track, tie-in buttons or any part of exterior enclosure assembly or construction.
      d. Visual Inspection: Check that the linear roller guide travels properly in the track before and after loading of the roller guide. Verify that tie-in buttons are clearly visible to workmen as they descend the building.
   9. Field Pressure Chamber Test

a. Standards: Test installed curtain wall systems according to AAMA 50202 "Voluntary Specifications for Field Testing of Windows and Sliding Glass Doors", Method B and AAMA 50303 "Voluntary Specifications for Field Testing of Storefronts, Curtain Walls and Sloped Glazing Systems". Conduct ASTM E1105 "Water Test" and E1186 "Bubble Gun Test" and E783 Qualitative Air Test.
b. Test Agency: Testing is to be carried out by an AAMA accredited independent agency.
c. The Exterior Enclosure System Contractor shall notify the Owner, the Owner's Representative, Architect, Construction Manager, and their relevant trades and subcontractors associated with the Test Sample, at least 1 week prior, that testing is to commence.
d. Test Sample Areas: For each Assembly type, one bay wide, but not less than 30 feet (9.1 m), by two stories tall.
e. Test Sequencing: Perform a test just prior to 10, 35, and 70 percent installation of the total Assembly type being tested.
f. Pressure Chamber Location: Locate the pressure box on the inside of the sample. Fully seal the perimeter of the test box to the sample air and water barrier.
g. Complete testing prior to installation of interior insulation, gypsum wall board and interior finishes.
h. Test specimen to include the perimeter material substrate and the perimeter seals.
i. Provide powered scaffold, hose, water supply, test chambers, communication system and manpower to perform tests.
j. Pretest: Prior to installation of insulation and rainscreen cladding, conduct a field test of the air and water barrier/rain screen assembly.
k. Air Infiltration: Test pressures and acceptable leakage rates shall be as Article "Performance Requirements; Weatherproofing; Air Infiltration/Exfiltration " but not less than 0.060 cfm/sqft of wall area at this pressure difference.
l. Water Penetration:
    1) Uniform Static Pressure: Uniform Static Pressure shall be 20 percent of the maximum positive wind pressure as Paragraph "Performance Requirements; Structural Loads; Wind Loads" but not less than 12psf.
    2) Leak Definition: There shall be no water leakage as defined by the more onerous of AAMA 501.1 paragraph 5, ASTM E331 or Paragraph "Performance Requirements; Weatherproofing; Water Penetration".
m. Provide nine (9) chamber tests of fenestration systems during installation, 2 chamber tests at each interval of testing, at locations on the building either requested by or acceptable to the Architect, and as follows:
    1) Provide three (3) field test for fenestration systems during installation, 2 chamber tests at each interval of testing, at locations on the building either requested or acceptable to the Architect, and as follows:
        a) Storefront
    2) Provide six (6) field tests for unitized curtain wall system(s); at the following locations identified on drawings:
        a) Mechanical floor access panel,
        b) Structurally glazed curtain wall metal panels with quenches and glass panels
        c) Louver/curtain wall interface. (Use blank off panels to close off louvers during testing)
        d) Removable panels
        e) Transitions between contiguous assemblies
        f) Expansion joints between systems.
        g) Perform water leakage tests at a static test pressure of 12.0 psf.
        h) Architect will determine necessity for revised test methods for additional tests based upon evaluation of initial test results.

i) Provide additional testing as directed by Architect at no cost to the Owner.

10. Air and Water Barrier/Rainscreen Assembly Testing:
    a. Pre-Test: For rain screen assemblies, prior to installation of insulation and rainscreen cladding, conduct a field test of the air and water barrier to determine if the air and water barrier complies with requirements for the air and water barrier and its backup system to sustain the full design wind pressures.
    b. Testing shall be equal to testing according to ASTM E2357 per ASTM E783 of the bubble test referenced in ASTM E1186 at locations with fasteners through the air and water barrier.
    c. Test Method: Test in accordance with AAMA 501.2
    d. Test Sample Areas: Percentage of total areas to be defined by and acceptable to the Architect.
    e. Provide hose tests at locations indicated by or acceptable to the Architect including:
        1) Representative joints.
        2) Transitions.
        3) Flashings.
        4) Field air and water barrier.
    f. Test Sequence: Perform tests just prior to 10, 35, and 70 percent installation of the total assembly for each type being testing.
    g. Leak Definition: There shall be no water leakage as defined by the more onerous of AAMA 501.1 paragraph 5, ASTM E331 or Paragraph "Performance Requirements; Weatherproofing; Water Penetration".
11. Water-Spray Test (Hose Test)
    a. The Exterior Enclosure System Contractor shall notify the Owner, the Owner's Representative, Architect, Inspection agent, Commissioning Agent, Construction Manager, and their relevant trades and subcontractors associated with the Test Sample, at least 1 week prior, that testing is to commence.
    b. Test Method: Test in accordance with AAMA 501.2 with modifications as listed below.
    c. Test Agency: Testing is to be carried out by an AAMA accredited independent agency.
    d. Test Sample Areas: For each Assembly type, 10% of total area but not less than 200 square feet (20 square m).
    e. Test Sequencing: Perform tests just prior to10, 35, and 70 percent installation of the total Assembly type being tested.
    f. Leak Definition: There shall be no water leakage as defined by the more onerous of AAMA 501.1 paragraph 5, ASTM E331 or Paragraph "Performance Requirements; Weatherproofing; Water Penetration".
12. Field Test Evaluations and Interpretations
    a. Do not proceed with Assembly installation until successful test result is achieved.
    b. Test Failures: Correct all deficiencies observed as a result of Field Tests.
    c. Repeated Test Failures: For each of the first five (5) test failures, including retests, an additional three (3) equivalent sample areas of similar construction, as nominated by the Architect, shall be tested. For subsequent failures, an additional six (6) equivalent sample areas of similar construction, as nominated by the Architect, shall be tested according to AAMA 511 "Voluntary Guideline for Forensic Water Penetration Products".
    d. Test Costs: The Exterior enclosure system Contractor shall pay for the cost of testing. All costs for additional testing due to failed tests, including fees and costs incurred by the Owner and Architect shall be paid for by the exterior enclosure system Contractor.

C. Manufacturer's Field Service: Engage a factory-authorized service representative for each Assembly of the Exterior Enclosure System to inspect completed installation of its specific Components, including accessories and connection to adjacent assemblies. Report results in writing.

D. Repair or remove and replace applications of Exterior Enclosure System where inspections indicate that they do not comply with specified requirements.

E. Additional tests and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.10 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as assemblies are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of Exterior Enclosure System installation, clean finished surfaces as recommended by each assembly manufacturer. Maintain in a clean condition during construction.
   1. Debris caused by, or incidental to, the erection of the assemblies shall be removed from the site and disposed of legally.

B. After Exterior Enclosure System installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace components of the Exterior Enclosure System that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures before the date of Substantial Completion.

D. Institute protective measures required throughout the remainder of the construction period to ensure that the Exterior Enclosure System work will be without damage or deterioration, other than normal weathering, at time of acceptance.

END OF SECTION