

SECTION 23 00 10
GENERAL MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Contract and General and Supplementary Conditions and Division 1 Specifications are hereby made a part of Division 23 as fully as if repeated herein. Where provisions of Division 1 conflict, the greater or more strict shall prevail.
- B. This Section includes general administrative and procedural requirements for mechanical installations. The requirements included in this Section expand the requirements specified in Division 1.
- C. Examine all Divisions of the specifications and drawings to determine the complete Scope of the mechanical work mechanical work shall comply with the requirements indicated in all sections of Division 23.
- D. The work to be done under Divisions 23 of the Specifications shall include the furnishing of all labor, material, equipment, tools and appurtenances and performing all operations necessary to provide complete, fully functional systems in accordance with the Specifications, the Drawings and requirements of the applicable codes and standards listed herein. Where the specifications, drawings and applicable codes and standards conflict provide the greater or more strict requirement.
- E. Visit areas of construction where Work is to take place, and examine the construction site carefully, noting locations and conditions under which the Work will be performed and accepting the responsibility for performing the Work under the existing conditions.
- F. The work shall include the following specification sections:

Division 23 - Heating Ventilating and Air Conditioning

23 05 00 Common Work Results for HVAC

230513 Common Motor Requirements for HVAC Equipment

23 05 29 Supports and Anchors

23 05 53 Mechanical Systems Identification

23 07 00 Insulation

23 08 00 Mechanical General Commissioning Requirements

23 08 13 Testing, Adjusting and Balancing

23 09 00 Building Automation System

232300 Refrigerant Piping

23 30 00 Ductwork and Accessories

233600 Air Terminal Units

23 74 13 Packaged Rooftop Ventilation Units

238125 DLR Refrigerant Based Precision Cooling System

23 84 13 Humidifiers

- G. The work shall include, but not be limited to, providing equipment and items listed below and installing items furnished under other Divisions of these specifications.
1. Supplementary steel, channel and supports.
 2. All materials and appurtenances that can reasonably be inferred to be a part of the mechanical systems and necessary to its proper operation, but not specifically mentioned or indicated on the drawings, shall be furnished and installed without additional charge.
 3. Touch-up painting of prefinished equipment furnished or damaged.
 4. Fire stopping, smoke, acoustical and environmental seals.
 5. Furnish, erect, maintain, relocate, and remove all hoisting, rigging, staging and scaffolding required to perform the work of this Section of the specifications.
 6. Provide core drilling through concrete provide steel reinforcement and metal decking. Provide required sleeves.
 7. Compliance with construction requirements and procedures to qualify for LEED points.
 8. Attendance at and support of Integrated Testing of all systems. Include time for owner's Level 5 Integrated Systems Testing to be scheduled after completion of Level 4 Acceptance Testing. Include time to assist in producing and providing owner's required paperwork and documentation plus the equivalent of five 12-hour days for a foreman and three senior installers/technicians to assist and operate equipment during testing.
 9. Coordinate with the building trades:
 - 1) Structural members, pads, and building openings for mechanical equipment, ducts, piping, fans, etc., for use by this Contractor shown on the architectural and structural plans are the coordination responsibility of the mechanical contractor. Any changes in the above requirements after letting and accepting the mechanical contract will be paid for by this Contractor.
 - 2) Provide full time superintendent who shall oversee and coordinate the work with other trades and the A/E.
 10. Coordinate with Owners equipment and piping systems:
 - 1) This Contractor shall coordinate the layout of his work with the Owner to avoid conflict with the installation of the Owner's equipment and / or piping systems.
 11. Coordinate with electrical work:
 - 1) All motor starters, relays, contactors, etc. for packaged equipment shall be provided by this Contractor and shall meet the requirements of Division 26 Specifications.
 - 2) All other motor starters shall be provided by the Division 26 as part of motor control centers, unless otherwise indicated in Division 26 specifications or as indicated on the electrical drawings.
 - 3) All control wiring for control devices, magnetic coils, damper operators, etc. shall not exceed 120 volts. Where power voltage for equipment is over 120 volts, a transformer shall be provided and wired for the controls.
 - 4) 120 volt power wiring to solenoid and control valves, variable air volume terminals, damper operators, etc. is to be done under this Division 23, work by the Automatic Control Contractor, unless shown on the Electrical Drawings.
 - 5) 120 volt power source will be made available, under Division 26, at the distribution breaker panels as indicated on the electrical drawings.

1.2 RELATED WORK

- A. The following items of labor and material incidental and/or related to the installation of the Mechanical Work are specified under other Divisions of these Specifications unless specifically

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indicated otherwise. Provide and assist and coordinate work to meet requirements indicated in the Specifications and on the Drawings.

1. Cutting and patching in accordance with the requirements under Division 1.
 2. Temporary HVAC services including consumption fees are to be provided by the General Contractor in accordance with Division 1.
 3. Controlled environmental conditions for mechanical equipment per the manufacturer's recommendations or as specified in this Division is to be provided by the General Contractor.
 4. Excavation and backfilling, Division 2.
 5. Concrete work including forms for housekeeping pads for equipment, Division 3.
 6. Reinforcing steel, Division 5.
 7. Sealing penetrations through fire or smoke rated partitions, Division 7.
 8. Watertight penetrations through roof, Division 7.
 9. Flashing and caulking, Division 7.
 10. Setting of frames for access panels, Division 8.
 11. Painting of all equipment and material other than touch up of prefinished fixtures, equipment and other Mechanical components, Division 9.
 12. Utility (water, gas, steam) back charges will be paid by the General Contractor with no additional markups allowed. Refer to Section 01005 for Utility back charges.
- B. The following items incidental and/or related to the installation of the mechanical work will be furnished by others and wired and/or installed under this Section.
1. Install duct smoke detectors in ductwork per NFPA 72 under Division 23. Division 28 shall furnish quantity required to meet the installation requirements of NFPA 72.
- C. Furnish the following items for installation by others and provide coordination, cooperation, assistance and wiring as required:
1. Pitch pocket or approved roofing penetration material for piping penetrations for installation under Division 7.
 2. Furnish access panels as required for mechanical work behind finished surfaces or otherwise concealed for installation under Division 8.
- D. Install items purchased by others, coordinate delivery and be responsible for unloading from delivery vehicles, rigging, and for safe handling and field storage up to the time of installation. This Section shall be responsible for:
1. Coordination of delivery and shipping splits for size and weight restrictions of the project site.
 2. Any necessary field assembly and internal connections, as well as mounting in place of the items, including the purchase and installation of all dunnage supporting members and fastenings necessary to adapt them to architectural and structural conditions.
 3. Connection to building systems including the purchase and installation of all terminating fittings, lugs, etc. necessary to adapt and connect them to the building systems.
 4. Provide all work indicated in the specifications and on the drawings related to the pre-purchased items that are not specifically indicated as pre-purchased.
 5. Carefully examine such items upon delivery, and advise the General Contractor and Owner of any damages or defects noted, as well as the shipper.
 6. Installation, testing, coordination of vendor's work and responsibilities and compliance with warranty coverage, requirements and support.
- E. Pre-purchased equipment furnished by the owner:
1. Chillers
 2. Computer Room Air Conditioners
 3. Packaged Pumping System (PPS)
- F. Work by Owner:
1. Refer to Division 1 for additional requirements and information.

2. Accommodate concurrent work provided by owner.
- G. Existing Materials:
 1. All existing equipment and materials to be reused is assumed to be in good operating condition.
 2. Any existing mechanical equipment to be reused found to be defective, upon commencement of this contract, shall be reported to the Architect.
 3. Guarantee all replacement work, equipment or materials for a period of one year from date of acceptance by the Engineer.

1.3 COORDINATION OF THE WORK

- A. Refer to Division 1 for additional requirements for coordination of the Work including Section 013100 Project management and coordination.
- B. Before submitting bid examine all Drawings and Specification, including other Divisions, for requirements that affect work of this Division and include it in the scope of work for this section whether or not such work is specifically mentioned in this Division. Be responsible, under this Division of the Specifications, for the proper coordination of the mechanical work with the installations under other Divisions, including proper clearances. Any changes required to avoid interferences shall be submitted to the Engineer for approval and shall be made as approved, without additional cost to the Owner.
- C. Coordinate work with that of all other trades affecting or affected by work of this Division. Cooperate with such trades to ensure the steady progress of work under the contract.
- D. Coordinate work with the General Contractor and the project schedule. Provide manpower and materials as required to meet the schedule and not to interfere with or impede the progress of or increase the cost of work by others. Submit shop drawings and order equipment in a timely manner. Expedite deliveries and manufacturing as required.
- E. Deliver products to the project in a timely manner to meet all schedule requirements, properly identified with names, model numbers, compliance labels and other information needed for identification.
- F. Install materials and apparatus as fast as conditions of the building will permit. Materials and apparatus must be installed when directed and in the fashion specified. Examine the Architectural Drawings for the location of suitable openings and aisles for the passage of equipment to be installed under this Section. The installer shall be responsible for having suitable openings and aisles left open until his equipment has been properly installed. If necessary, request the vendor to ship equipment in sections sized to permit passage. Provide sleeves, pockets, supports and incidentals.
- G. Examine the drawings and the building construction for weight and size restrictions. Provide equipment and installation methods to comply with restrictions including shipping split sizes, weights, and disassembled components as required. Obtain manufacturer's approval and assurance warranty will be honored.
- H. Prepare and submit coordination drawings in conjunction with the other Trades, on common drawings of at least 3/8"=1'-0", as directed by the General Contractor. Each system shall be color-coded, and for CAD drawings, each system shall be on a different layer. Meet to resolve conflicts between the various Installers prior to submission to the Engineer for review. Identify conflicts resolved that include changes to the design. Note on coordination drawings submitted to the Engineer any conflicts that the trades could not resolve. The Engineer will provide direction that all Installers will comply with, at no additional cost to the project. In general, distribution systems which require pitch or slope such as plumbing drains, steam and condensate piping shall have the right of way over those which do not. Lighting fixtures have minimal flexibility and should not be moved without prior approval. Install work to avoid

interferences and to allow proper clearance around all trades' work for access, maintenance and as required by code. Prepare coordination drawings in the following order (subject to above): HVAC (with lighting fixtures indicated), plumbing, fire protection, electrical and telecommunications systems. Work installed prior to complete and reviewed coordination drawings must be corrected as required at no additional expense to the project.

I. Coordination Drawings:

- a. General: Electronic copies of CAD Drawings of the Contract Drawings will be provided by A/E for Contractor's use in preparing coordination drawings
 - 1) A/E makes no representations as to the accuracy or completeness of CAD Drawings as they relate to the Contract Drawings.
- b. Prepare and submit coordination Drawings where close and careful coordination is required for installation of products and materials fabricated off-site by separate entities, and where limited space availability necessitates maximum utilization of space for efficient installation of different components.
 - 1) Show the interrelationship of components shown on separate Shop Drawings.
 - 2) Indicate required installation sequences.
 - 3) Comply with requirements contained in Section "Submittals."
- c. Prepare coordination drawings to a scale of 1/4"=1'-0" or larger; detailing major elements, components, ductwork, piping, conduits and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:
 - 1) Indicate the proposed locations of piping, ductwork, equipment, and materials. Include the following:
 - a) Clearances for installing and maintaining insulation.
 - b) Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.
 - c) Equipment connections and support details.
 - d) Exterior wall and foundation penetrations.
 - e) Fire-rated wall and floor penetrations.
 - f) Sizes and location of required concrete pads and bases.
 - g) Valve stem movement.
 2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
 3. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
 4. Prepare reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communication systems components, sprinklers, and other ceiling-mounted items.
 - d. Submit one set of CAD Coordination Drawings, and three sets of CAD Coordination Drawing plots.
- J. In all spaces, prior to installation of visible material and equipment, including access panels, review Architectural Drawings for exact locations and where not definitely indicated request information from Architect.
- K. Check Contract Drawings as well as Shop Drawings of all Installers and vendors to verify and coordinate space in which work of this section will be installed.
- L. Obtain from manufacturers the proper method of installation and connection of the equipment that is to be furnished, installed or wired. Obtain all information that is necessary to facilitate the work and to complete the project.

1.4 QUALIFICATIONS / QUALITY ASSURANCE

- A. Refer to Division 1 for additional requirements for quality assurance and control of the installation.
- B. Receive, handle, house, and protect equipment required for installation under this specification. Replace damaged equipment with new equipment. Provide environmental requirements per NFPA 70B and manufacturer's requirements during shipping, storage and installation.
- C. Review submittals of equipment furnished under other Divisions prior to installation and rough-in. Verify location, size, and required connections. Coordinate details of equipment connections with supplier and installer.
- D. Utilize installers with at least five years experience in the type of work to be performed.
- E. Manufacturers shall be companies experienced in manufacturing products specified for a minimum of five years.
- F. Be responsible for the care and protection of all work included in this Section until it has been tested and accepted.
- G. Protect all equipment and materials from damage from all causes including theft. All materials and equipment damaged or stolen shall be repaired or replaced with equal material or equipment.
- H. Protect all equipment, outlets and openings with temporary plugs, caps and covers. Protect work and materials of other trades from damage that might be caused by work or workmen and make good any damage caused.
- I. Provide workmanship in accordance with the best accepted practices. Rework installations judged by the Engineer as unacceptable.

1.5 REGULATORY REQUIREMENTS

- A. Refer to Division 1 for additional regulatory or reference requirements.
- B. Arrange and pay for permits, licenses, inspections and certificates. Give the proper Authorities all requisite notices or information required relating to the work under this Section. Request inspections from Authorities having jurisdiction. At the conclusion of the work, deliver certificates of inspection from authorities having jurisdiction to the Owner's Representative.
- C. Provide products listed and classified by an OSHA certified Nationally Recognized Testing Laboratory (NRTL) as suitable for purpose specified and indicated. Provide NRTL-listed material and equipment where standards are available. Notify Engineer of any material or equipment that is not NRTL listed when submitting information.
- D. Perform work in strict accordance with the rules, regulations, listing or labeling requirements, standards, codes, ordinances, and laws of local, state, and Federal governments, and other authorities having legal jurisdiction over the site. No additional compensation shall be granted for work that must be changed as a result of the work not originally complying with the codes, standards, local requirements, etc.
- E. Equipment and installation shall be suitable for the Seismic requirements indicated in the Building Code for the location and usage.
 - 1. Component Importance factor is 1.0
 - 2. Seismic Design Category is A
 - 3. Site Class is C

4. Building Classification (Occupancy Category) per ASCE 9- category II
- F. Materials and equipment shall be manufactured, installed and tested as specified in the latest and required editions of applicable parts of the following publications, standards and rulings of:
- | | | |
|-----|--------|--|
| 1. | AABC | Associated Air Balance Council |
| 2. | AASHTO | American Association of State Highway and Transportation Officials |
| 3. | ACPA | American Concrete Pipe Association |
| 4. | ADC | Air Diffusion Council |
| 5. | AFBMA | Anti-Friction Bearing Manufacturers Association |
| 6. | AGA | American Gas Association |
| 7. | AIHA | American Industrial Hygiene Association |
| 8. | AISC | American Institute of Steel Construction |
| 9. | AISI | American Iron and Steel Institute |
| 10. | AMCA | Air Movement and Control Association |
| 11. | ANSI | American National Standards Institute |
| 12. | API | American Petroleum Institute |
| 13. | ARI | Air Conditioning and Refrigeration Institute |
| 14. | ASA | Acoustical Society of America |
| 15. | ASC | Adhesive and Sealant Council |
| 16. | ASHRAE | American Society of Heating, Refrigerating |
| 17. | ASME | American Society of Mechanical Engineers |
| 18. | ASPE | American Society of Plumbing Engineers |
| 19. | ASSE | American Society of Sanitary Engineering |
| 20. | ASTM | American Society for Testing and Materials |
| 21. | AWS | American Welding Society |
| 22. | AWWA | American Water Works Association |
| 23. | CAGI | Compressed Air and Gas Institute |
| 24. | CGA | Compressed Gas Association |
| 25. | CISPI | Cast Iron Soil Pipe Institute |
| 26. | CRSI | Concrete Reinforcing Steel Institute |
| 27. | ETL | ETL Testing Laboratories, Inc. |
| 28. | FM | Factory Mutual Engineering and Research Organization |
| 29. | IEEE | Institute of Electrical and Electronic Engineers |
| 30. | ISA | Instrument Society of America |
| 31. | MCAA | Mechanical Contractors Association of America |
| 32. | MSS | Manufacturers Standardization Society of the Valve and Fittings Industry |
| 33. | NEC | National Electric Code (Now NFPA) |
| 34. | NEMA | National Electrical Manufacturers Association |
| 35. | NFPA | National Fire Protection Association |
| 36. | NSF | National Sanitation Foundation |
| 37. | PCA | Portland Cement Association |
| 38. | PDI | Plumbing and Drainage Institute |
| 39. | SMACNA | Sheet Metal and Air Conditioning Contractors National Association |
| 40. | SSPMA | Sump and Sewage Pump Manufacturers Association |
| 41. | SWPA | Submersible Wastewater Pump Association |
| 42. | TIMA | Thermal Insulation Manufacturers Association |
| 43. | UL | Underwriters Laboratories |
| 44. | WSC | Water Systems Council |
- G. Where conflicts occur among the codes, ordinances, standards, Drawings or Specifications, the more restrictive requirements shall govern.
- H. The Drawings and Specifications do not undertake to repeat requirements written or all work required in the above codes, ordinances and standards.
- I. Comply with applicable codes and regulations regarding toxicity of combustion products of materials used.

- J. Legally dispose of all material. Adhere to all regulations regarding disposal of hazardous material. Recycle hazardous material where recycling is possible. Submit certificates of legal recycling or disposal to the Architect. Include copy in the Owner and Maintenance Manual.
- K. Public utility back charges will be paid for by the Owner and are not to be included in the base bid. Submit charges to Owner without markups, for Owner to process directly or as a change order to the Contract. Markups on utility back charges will not be allowed.
- L. Nothing in these Contract Documents shall be construed to permit work not conforming with applicable codes and regulations. When conflicts occur the more restrictive requirements shall govern.
- M. Should the Facility have established building standards, rules or regulations, obtain a copy from the Building Owner and comply with them.

1.6 SUBMITTALS

- A. Provide and submit under provisions of Division 1 and as indicated herein.
- B. Submit at time of bid any equipment or materials that have lead times that will affect the construction schedule. Provide alternate costs to expedite delivery and manufacturing so that the project schedule can be accomplished.
- C. Submit at time of bid, any proposed substitutions. List reasons the owner should accept substitutions including improved performance or equal performance and improved delivery time. Acceptance of substitutions is subject to acceptance by the Engineer, whose decision will be final. A substitution is considered to be any manufacturer or product not specifically identified in the specifications or drawings. If only performance requirements are indicated, and no specific manufacturer is indicated, then a manufacturer meeting the contract document requirements is not considered a substitute.
- D. Substitutions of specifically indicated items will be reviewed only if identified at time of bid, otherwise submittals will be returned rejected. It is the proposer's responsibility to submit the first time, all information required to prove equality and a written letter on the proposer's letterhead indicating that the item is in full compliance with the Contract Documents and will fit in the designated location. Include in bid, coordination of all work and all costs for all trades for any work that may be required, including any architectural or engineering fees, to accommodate the substitution. Acceptance of the proposed substitution is up to the Engineer and is not assured. Review will include, but is not limited to, quality, life cycle costs, size, appearance, construction, manufacturer, service record, efficiency, dependability, performance, etc.
- E. Submit for review, within 10 days after being given Notice to Proceed and prior to the submission of any shop drawings, an itemized list of manufacturer's of material and equipment and of firms or subcontractors proposed to be used to perform the work. Include a list of submissions and the proposed schedule to submit them, so that based on the approval times and procedures indicated below, the proposed project schedule will be accomplished. FAILURE TO SUBMIT WITHIN THE TIME LIMIT OF 10 DAYS WILL BE CONSIDERED A CONTRACT VIOLATION and will require that all items will be provided in a timely manner to maintain the schedule and all costs required to meet the schedule are included to expedite delivery and manufacturing.
- F. After approval of the list and schedule, submit 8 sets of detailed Shop Drawings and product Data per the submission schedule or within 30 days or sooner if required to meet the construction schedule. Substitutions will not be accepted for failure to comply with the schedule above.

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- G. Submit related shop drawings at one time. SUBMIT ALL ITEMS IN A SPECIFICATION SECTION AT THE SAME TIME. Incomplete submittals will be held until a complete submittal is accumulated.
- H. The review of systems, equipment and Shop Drawings is a general review subject to the Contract Drawings, specifications and verification of all measurements at the job. Review does not relieve the installer from the responsibility of Shop Drawing errors or complying with the Specifications and Drawings. Carefully check and correct all Shop Drawings prior to submission for approval. Regardless of any information included in the shop drawings submitted for review, the requirements of the Contract Documents shall not be superseded in any way by the Shop Drawing Review.
- I. Mark submittals to clearly identify (including when photocopied) proposed equipment including their accessories, options, and modifications and exclude parts not applicable to the Project, otherwise the Engineer will identify items and options to be provided at no additional cost to the project.
- J. Each submittal shall be reviewed, stamped and certified prior to submission to the Engineer. Such certification shall be made by a person duly authorized to sign binding Agreements for the Contractor. The certification shall state that the data and details contained on each Shop Drawing, layout drawing, catalog data and brochure has been reviewed by the Contractor for conformance to the contract documents and that it complies with the Contract Documents in all respects. Submittals will not be reviewed and will be returned to the Contractor unchecked unless they are certified.
- K. It is intended that Submittals be complete and accurate at the first submission. If the Submittal is returned marked "Resubmit," only one additional submittal will be permitted. If the second Submission is not acceptable, the right of selection will be lost and the Engineer will specify exactly what is required and the specified products shall be provided at no additional cost to the Project.
- L. A minimum period of two weeks, exclusive of transmittal time, will be required by the Engineer's office each time Submittals are submitted or resubmitted for review. This time period shall be considered when scheduling the work, and any costs associated with expediting equipment delivery to meet the Schedule will be at no additional cost to the Owner. Submittals of numerous items at the same time may extend the time needed for review, so plan accordingly.
- M. Provide submittals in a timely manner sufficiently in advance to give ample time for checking, correcting, resubmitting and rechecking if necessary. No claim for delay or additional costs will be granted for failure to comply with this requirement.
- N. If proposed equipment deviates from the Specifications or Drawings, indicate those differences and provide sufficient data to justify acceptance. FAILURE TO INDICATE DEVIATIONS OR SUBSTITUTIONS IMPLIES FULL COMPLIANCE WITH DRAWINGS AND SPECIFICATIONS.
- O. Indicate clearly all equipment, components or assemblies that are not NRTL listed or labeled. Failure to indicate otherwise implies NRTL listing or labeling.
- P. Provide products of one manufacturer for each classification of equipment.
- Q. Meet Project requirements including space, size and weight restrictions before submitting to Engineer. Equipment shall be of proper size for its allocated space. Equipment may be disassembled so that it can be installed through available openings only if it will not invalidate manufacturer's warranties.
- R. At the job site, maintain the latest equipment submittals showing the action taken by the Engineer. Make these submittals available to Engineer.

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- S. Any items with a tag number must be submitted for approval. Submittals shall provide all pertinent data and information necessary to evaluate each item. Certified Drawings and catalog data sheets shall show:
1. Applicable specification section number and equipment tag number.
 2. Principal dimensions and details of construction.
 3. Weights of principal parts and total weights with information required for the design of supports and foundations.
 4. Sizes and locations of piping and connections.
 5. Performance data, including pump and fan curves; fan discharge and inlet noise data; certified by the manufacturer for the equipment furnished.
 6. Data on electric motors, including brake HP of driven equipment, nameplate ratings and classes, and starting and running full load currents.
 7. Approval stamp of Underwriters and other authorities having jurisdiction of drawings requiring such approval.
 8. Submit Schedule of proposed piping fitting, valves, specialties, etc. along with manufacturer's catalog data.
 9. Automatic temperature control system including diagrammatic layout of piping, wiring, control devices, and equipment, and detailed descriptions of each item of equipment and its function in the system and system operation.
 10. Refrigeration for field-assembled systems including description of specialties and pressure drops, layout of piping with lengths, fittings, and refrigerant specialties, and capacity curves for evaporator and compressor showing balance points.
 11. Product Data: Submit catalog data sheets or other published materials showing appearances, electrical ratings characteristics and connection requirements, performance characteristics, dimensions, weights, installation methods, and space requirements of mechanical equipment and their accessories, as listed below and required by the individual sections.
- T. Shop Drawings: Submit shop drawings (drawn to scale) indicating physical size and arrangement, (plans and elevations) construction details, provisions for conduits, access requirements for installation and maintenance, finishes, and materials used in fabrication. Supplement Shop Drawings with wiring diagrams and information as described under Product Data. Provide Shop Drawings for the following and as required by the individual sections:

Division 23 - Heating Ventilating and Air Conditioning

23 05 00 Common Work Results for HVAC

230513 Common Motor Requirements for HVAC Equipment

23 05 29 Supports and Anchors

23 05 53 Mechanical Systems Identification

23 07 00 Insulation

23 08 00 Mechanical General Commissioning Requirements

23 08 13 Testing, Adjusting and Balancing

23 09 00 Building Management System

232300 Refrigerant Piping

23 30 00 Ductwork and Accessories

233600 Air Terminal Units

23 74 13 Packaged Rooftop Ventilation Units

238125 DLR Refrigerant Based Precision Cooling System

23 84 13 Humidifiers

- U. Specification Comparison: In addition to the complete Shop Drawings required above, provide:
1. A complete copy of the specifications (Reduced in size to allow a Comment Column), with each sub-paragraph noted with comment, "compliance," "deviation", or "alternate". In the case of non-primary, vendor-supplied items, the name of the sub-vendor supplying said item, including model number shall be indicated.
 - a. By noting the term "compliance", it shall be understood that the manufactures are in full compliance with the item specified and will provide exactly the same with no deviations.
 - b. By noting the term "deviation" it shall be understood that the proposer prefers to provide a different component that performs the same function in lieu of that specified. Indicate all deviations and indicate what is being proposed, with enough detail to determine equivalency.
 - c. By noting the term "alternate" it shall be understood that the proposer proposes to provide the same operating function but prefers to do it in a different manner. An alternate shall be fully described as to what the proposer proposes to provide. Indicate any function or feature that is not provided. Specification Comparison: In addition to the complete shop drawings required above provide
 2. Provide Specification reviews for the following:
 - a. Chillers
 - b. Computer Room Air Handlers
 - c. PPS
 - d. Building Automation System
- V. Manufacturer's Instructions:
1. Indicate application conditions and limitations of use stipulated by product testing agency specified under regulatory requirements.
 2. Include instructions for storage, handling, protection, examination, preparation, operation and installation of product.
 3. Include instructions on manufacturer's requirements for cable restraint in equipment.
 4. Submit manufacturer's standard and recommended receiving, start up and acceptance testing checklists.
- W. In addition to copies of submittals as required under Operation and Maintenance Manuals, provide electronic copies on CDs or DVDs of all submittal information in PDF or Microsoft Word format with O&M manuals.

1.7 EXTRA MATERIALS

- A. Provide extra materials as specified in each section.
- B. Extra materials shall be turned over to the Owner prior to receiving final payment. Obtain itemized receipt properly signed and dated. Submit with request for final payment.
- C. Extra materials shall be in original standard manufacturer's packaging.

1.8 PROJECT RECORD DOCUMENTS

- A. Provide and submit under provisions of Division 1 and this Section the following:
 1. Record Drawings
 2. Specifications

3. Product Data
 4. Operation and Maintenance Manual.
 5. Equipment Warranties.
 6. Certification of proper disposal of regulated materials.
 7. Certificates and Start-up checklists.
 8. Testing and Balancing reports.
- B. Refer to Division 1 for additional Project record document requirements beyond those indicated herein.
- C. Provide and maintain at the site a set of prints on which shall be accurately indicated the actual installation of all work under this Division, indicating any variation from Contract Drawings, including change orders, field conditions, Engineer's direction and changes in sizes, locations and dimensions. Changes in circuitry shall be clearly and completely indicated as the work progresses. Modify Schedules to reflect data consistent with that of the installed equipment.
- D. Record Drawings shall be maintained in a clean, dry and legible condition and shall not be used for construction purposes.
- E. These progress prints shall be available for inspection by the Engineer and shall be used to determine the progress of electrical work. Indicate daily progress by color-coding materials and apparatus installed. Progress prints shall be reviewed weekly and shall be corrected immediately if found inaccurate or incomplete. Drawings will be used as a guide for determining the progress of the work installed. Requisitions for payment will not be approved until the Drawings are accurate and up-to-date.
- F. At the completion of the work, obtain and pay for a new set of 4-mil mylar washoff sepia reproducible record drawings, modify drawings to represent the work as actually noted on the marked-up prints, including the DIMENSIONED location of all underground conduit. Remove all superseded data to show only the completed installation. Mark all Drawings as "Final Record Drawings" and date them.
- G. Electronic files shall be AutoCad 2008 as a minimum.
- H. Furnish these record documents to the Engineer for review and transmission to the Owner.
- I. Record Drawings: Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately; where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.
1. Mark new information that is important to the Owner, but was not shown on Contract Drawings or Shop Drawings.
 2. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set.
 3. Ductwork mains and branches, size and location, for both exterior and interior; locations of dampers and other control devices; filters, boxes, and terminal units requiring periodic maintenance or repair.
 4. Mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.). Valve location diagrams, complete with valve tag chart. Refer to Division 15 Section "Mechanical Identification." Indicate actual inverts and horizontal locations of underground piping.
 5. Equipment locations (exposed and concealed), dimensioned from prominent building lines.

6. Approved substitutions, Contract Modifications, and actual equipment and materials installed.
7. Contract Modifications, actual equipment and materials installed.
8. Include all "Corrected For Record" shop drawings to reflect approvals received.
 - a. Engage the services of a Land Surveyor or Professional Engineer registered in the state in which the project is located to record the locations and invert elevations of underground installations.
 - b. Mark Specifications to indicate approved substitutions and actual equipment and materials used.
 - c. Number of Copies: Submit copies of Record Drawings as follows:
 - 1) Initial Submittal: Submit one set of plots from corrected Record CAD Drawings and one set of marked-up Record Prints. A/E will initial and date each plot and mark whether general scope of changes, additional information recorded, and quality of drafting are acceptable. A/E will return plots for organizing into sets, printing, binding, and final submittal.
 - 2) Final Submittal: Submit three sets of Record CAD Drawing files, and three sets of Record CAD Drawing plots. Plot each Drawing, whether or not changes and additional information were recorded.
 - 3) Electronic Media: CD-ROM.
 - 4) Format: Same CAD program, version, and operating system as the original Contract Drawings.
 - 5) Refer instances of uncertainty to A/E for resolution.

1.9 OPERATING INSTRUCTIONS AND MAINTENANCE DATA

- A. In addition to the requirements of section 017823 provide the following after completion of the work and prior to final completion, furnish and deliver six copies of a complete O&M manual. Each manual shall include one copy of each approved shop drawing, catalog pages, instruction sheets, operating instructions, installation, instructions and recommended maintenance procedures and intervals, and spare parts bulletins. Provide separate sections for each separate system, i.e., fire alarm system, sound system, security system, etc.
- B. Give detailed instructions, using additional manuals, prior to final completion of work, to the responsible personnel designated by the Owner in the operation and maintenance of all work installed under this Division. All instructions shall be recorded on DVD with two copies of the DVD turned over to the Owner upon completion of the instruction period. Recording of the instructions shall include a description of the system as well as detailed operating and maintenance instructions. Recording sessions will be of professional quality and performed by a firm regularly employed in that business. A letter with two copies containing the name of the person or persons to whom the instructions were given and the dates of the instruction period shall be submitted to the Engineer at the completion of the project. Provide recorded instructions for the following:
 1. Building Monitoring System
 2. Precision Cooling System CRAC / ACC
 3. RTUs
 4. MUAs
- C. Prepare sets of manufacturer's catalogs, and other similar data, including the necessary photographic equipment cuts, wiring diagrams covering all mechanical equipment and devices furnished and installed under this Section. These manuals shall provide complete instructions for the proper operation and use of the equipment, together with instructions for lubrication and periodic maintenance and trouble-shooting. Operating instructions shall be specific for each system and shall include copies of posted specific instructions. This manual shall contain only that information which specifically applies to this Project and all unrelated material shall be deleted. During the instruction period, this manual shall be used and explained. The material shall be bound in 3-ring binders, indexed and have a Table of Contents. On the edge of the binder, provide a clear, see-through plastic holder with a typed card indicating the Project

name, the Architect's name, the Installer's name and the Volume number (e.g., Vol. No. 1 of 2).

- D. Include a copy of all test reports and certifications in the O&M Manuals.
- E. Include name, address and telephone number of the manufacturer's representative and service company for each piece of equipment so that the source of replacement parts and service for each item of equipment can be readily obtained.
- F. Provide four copies of the O&M manual information on CD ROM or DVD. Files shall be in a readable format such as PDF or image files (TIF, etc). Record drawings shall be scanned in, and shall also include the AutoCad dwg files if Record Drawings are provided on Cad.
- G. Furnish these manuals to the Architect for review and transmission to Owner.

1.10 WARRANTY

- A. Refer to individual sections and Division 1 for additional warranty (guarantee) requirements.
- B. Remedy work performed under this Division that is found not to comply with the Contract Documents, requires excessive service, or fails less than one year from the date of final acceptance.
- C. Manufacturers shall provide their standard warranties for material and equipment furnished under this Division, unless otherwise indicated in each Section.
- D. Materials, equipment and work furnished under this Division shall be guaranteed against all defects in materials and workmanship for a period of one year, commencing with the date of final acceptance by the Owner. Any failure due to defective material, equipment or workmanship shall be corrected as quickly as possible and at no expense to the Owner, including all damage to areas, materials and other systems resulting from such failures.
- E. Upon receipt of notice from the Owner of failure of any part of the systems during the guarantee period, the affected parts shall be replaced as quickly as possible. Any equipment requiring excessive service (more than two unscheduled services) shall be considered defective and shall be replaced.

1.11 LEED SUSTAINABILITY

- A. Comply with the requirements of section 018113-Sustainable Design requirements.
- B. Minimize packing materials delivered to the site to minimize waste and maximize opportunity for qualifying for LEED points.

1.12 INTERPRETATION OF CONTRACT DOCUMENTS

- A. Division one, General and Supplementary Conditions are in addition to the requirements indicated in Division 23 and 28, Drawings and Specifications.
- B. Where Drawings or Specifications conflict or are unclear, advise Engineer in writing before Award of Contract. Otherwise, interpretations of Contract Documents by the Engineer shall be final, and no additional compensation shall be permitted due to discrepancies or unclarities resolved according to the Engineer's interpretation.
- C. The intent of the Drawings and Specifications is to assist and guide and to establish minimum requirements.

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- D. Drawings and Specifications form complimentary requirements; provide work specified and not indicated, and work indicated and not specified as though explicitly required by both.
- E. Should there be conflicts in Contract Documents, provide the greater quantity, the higher quality and the more restrictive of equipment and work.
- F. Specifically stated requirements supersede general ones.
- G. Mechanical Drawings do not limit responsibility of determining full extent of work required by Contract Documents. Refer to Architectural, HVAC, Electrical, Plumbing, Fire Protection, Structural, specialty trades and other Drawings and other Divisions that indicate types of construction in which work shall be installed and work of other trades with which work of this Division must be coordinated.
- H. Except where modified by a specific notation to the contrary, it shall be understood that the indication and/or description of any item, in the Drawings or Specifications or both, carries with it the instruction to furnish and install the item, regardless of whether or not this instruction is explicitly stated as part of the indication or description.
- I. Items referred to in singular number in Contract Documents shall be provided in quantities necessary to complete work.
- J. Where Drawings or Specifications do not coincide with manufacturer's recommendations, or with applicable Codes and Standards, alert Engineer in writing before installation. Otherwise, make changes in installed work as Engineer requires within Contract Price.
- K. It is the intent of these Contract Documents to have systems and components that are fully complete and operational and fully suitable for the intended use. There may be situations in the documents where insufficient information exists to precisely describe a certain component or subsystem, or the routing of a component. In cases such as this, where the bidder has failed to notify the Engineer of the situation prior to contract award, provide the specific component or subsystem with all parts necessary for the intended use, fully complete and operational, and installed in workmanlike manner either concealed or exposed per the design intent.
- L. In situations or where potential conflicts and Installer believes guidance is required, submit a sketch identifying a proposed solution and the Engineer shall review, note if necessary, and return this sketch appropriately marked as required.
- M. Portions of these Drawings and Specifications are abbreviated and may include incomplete sentences. Infer the omitted words or phrases such as "the Contractor shall", "shall be", "as indicated on the Drawings", "in accordance with details", "a", "the", and "all".
- N. "As permitted" means by Code, by Engineer or by prevailing conditions.
- O. "Acceptable", "approved", and "satisfactory" means by Engineer.
- P. Work indicated on the Drawings is intended to be approximately correct to scale, but figures, dimensions, and detailed Drawings are to be followed. Take measurements at the building before fabrication commences.
- Q. Size of pipes or conduits and methods of installing them are indicated, but it is not intended to show every offset and fitting, nor every structural difficulty that may be encountered.
- R. Drawings are generally diagrammatic and indicate the arrangement and approximate location of fixtures, equipment and piping. When necessary to deviate from the arrangement indicated, to meet structural conditions or to clear work of other Divisions, inform the Engineer of

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proposed deviation before proceeding. Obtain in the field all information relevant to the placing of mechanical work.

- S. Drawings and Specifications do not undertake to indicate every item required to produce a complete and properly operating installation. Materials, equipment or labor not indicated but which can be reasonably inferred to be necessary for a fully complete, secure and properly operating installation suitable for the intended use shall be provided.
- T. The right is reserved to make reasonable changes in locations of equipment indicated in Drawings prior to installation without increase in contract cost.
- U. Contract Documents indicate scope of work required. Jurisdictional assignment shall be a responsibility under this Section's contractual obligation.
- V. The following definitions apply to the Drawings and Specifications:

Furnish: The term "furnish" is used to mean "supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations."

Install: The term "install" is used to describe operations at project site including the actual "unloading, unpacking, rigging in place, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations".

Provide: The term "provide" means to "furnish and install, complete and ready for the intended use".

Installer: An "Installer" is the Contractor or an entity engaged by the Contractor, either as an Employee, Subcontractor, or Sub-Subcontractor for performance of a particular construction activity, including installation, erection, application, and similar operations. Installers are required to be experienced in the operations they are engaged to perform.

1.13 TEMPORARY HEATING AND COOLING

- A. Work provided under Division 1.

1.14 ALTERNATES

- A. Refer to Division 1 and Section 01 23 00 for additional requirements.

PART 2 - PRODUCTS

2.1 SPECIFIED PRODUCTS AND SUBSTITUTIONS

- A. Provide new, unused, full weight, standard equipment that meets or exceeds Contract Document requirements to the satisfaction of the Engineer. No equipment or material shall be used unless previously approved by the Engineer.
- B. The manufacturer's catalog number and description is the basis of the design and establishes quality and performance required for this project. Generality, the first manufacturer listed is the one the project design is based on.
- C. Manufacturers of generally compatible products may also be listed, subject to compliance with requirements. Substitution of equal products or manufacturers of equal products are also acceptable when indicated in each section.

- D. The description following a catalog number is basically to identify the item but may also call for accessories, options, or modifications that are beyond the cataloged item.
- E. Zinc Whiskers:
 - a. Major data processing equipment suppliers have raised concerns over the potential for airborne zinc whiskers to damage their equipment. Zinc whiskers form on steel that is galvanized via a zinc electroplating process. Zinc whiskers do not form on steel that has been hot dipped galvanized. Do not use zinc-electroplated components in areas with raised access floors.
 - 1) Use materials under the raised access floors that are hot dipped galvanized steel or other material, but not zinc-electroplated.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prior to beginning work in a particular area of the project visit the site and examine conditions under which work must be performed, including preparatory work done under other Divisions or Contracts or by the Owner. Report conditions that might affect work adversely in writing through Contractor to Engineer. Do not proceed with work until defects have been corrected and conditions are satisfactory. Commencement of work shall be construed as complete acceptance of existing conditions and preparatory work.
- B. Arrangements shall be made to have the openings, inserts, sleeves and other such incidentals set in place ahead of the construction work, where practical to eliminate the need for cutting and patching. If cutting becomes necessary for the installation of the work, it shall be done under this Division in accordance with the requirements of Division 1 and other applicable divisions. All openings shall be neatly patched and finished to match the adjoining work in a manner approved by the Architect, any penetration in fire-rated walls or floors must be fire-stopped as indicated in Division 7. All cutting shall be performed in a manner not to weaken the structural parts. The cutting manner and method shall meet the approval of the Architect.
- C. The equipment shall be kept upright at all times. If equipment has to be tilted for ease of passage through restricted areas, the manufacturer shall brace the equipment to ensure that the tilting does not impair the functional integrity of the equipment. Comply with manufacturer's requirements.

3.2 INSTALLATION

- A. Do not cut structural members without written acknowledgement from the Architect.
- B. Do not attach equipment to metal roof decking.
- C. Arrange equipment so working parts are accessible for inspection, repair, and renewal.
- D. Where not specified or indicated, mount equipment at heights directed by the Engineer.
- E. Locate equipment, test switches, control pushbuttons, terminal cabinets, safety switches and such other apparatus as may require periodic maintenance, operation, or inspection, so that they are easily accessible. If such items are shown on the plans in locations that are found to be inaccessible, advise the Engineer of the situation before work is advanced to the point where extra costs will be involved.
- F. Any work installed contrary to Contract Drawings shall be subject to change as directed by the Engineer, and no extra compensation will be allowed for making these changes.

- G. Where installed in damp, wet and areas requiring washing down, all surface mounted equipment shall be supported by spacers to provide a clearance between wall and equipment.
- H. All connections to equipment shall be made as required, and in accordance with the approved shop and setting drawings.
- I. Unless otherwise approved by the Engineer, piping indicated exposed shall be installed exposed; piping indicated concealed shall be installed concealed.
- J. Where exact locations are required for roughing in, stubbing-up and terminating conduit request Shop Drawings, equipment location drawings, foundation drawings, and any other data required to locate the concealed conduit before the floor slab is poured or wall or ceiling is installed.
- K. Verify the ceiling type ceiling suspension system and clearance above hung ceilings prior to ordering grilles or diffusers. Notify the Engineer of any discrepancies.
- L. Fire ratings of enclosures, walls, ceilings, and floors shall be maintained. Penetrations for mechanical Work shall be fire-stopped as indicated in Division 7 or indicated in individual Sections on Drawings, or by Architect. Review Architectural drawings for fire ratings.
- M. Water tightness of enclosures, walls, ceilings, and floors shall be maintained. Provide necessary fittings, accessories and coordination as required.
- N. Do not use power actuated anchors.

3.3 TESTING AND INSPECTIONS

- A. For additional requirements for starting, demonstration, and instructions of systems refer to Division 1.
- B. Provide starting, demonstration, and instructions of systems as required in individual Sections.
- C. Insure that the Owner's operating personnel are made entirely familiar with the nature, operation, and maintenance of the systems and equipment provided under this Division.
- D. Provide testing as indicated in individual sections and in Section 260813. Submit written results.

3.4 SUBSTANTIAL COMPLETION

- A. For additional requirements refer to Section 017700 Closeout Procedures.
- B. When Work under this Section (or designated portion of Work) is considered substantially complete, submit written notice through the General Contractor with a list of items remaining to be completed or corrected.
- C. All systems shall be operational and tested. Submit test reports.
- D. Submit local authority final sign off inspection reports.
- E. Should Engineer observe and find Work is not substantially complete, written notification will be provided listing observed deficiencies.
- F. Remedy deficiencies and send a second written notice of substantial completion.
- G. When Engineer finds Work is substantially complete, a Certificate of Substantial Completion will be prepared in accordance with provisions of General Conditions.

- H. Submit test reports for review prior to Engineer's site visit.

3.5 FINAL COMPLETION

- A. For additional requirements refer to Section 017700 Closeout Procedures.
- B. When Work under this Section is considered complete, submit through the General Contractor written certification that:
1. Contract documents have been reviewed.
 2. Work has been inspected for compliance with Contract Documents.
 3. Work has been completed in accordance with Contract Documents (and deficiencies listed with Certificate of Substantial Completion have been corrected).
 4. Equipment and systems have been tested, adjusted and balanced and are fully operational.
 5. Work is complete and ready for final Engineer review.
- C. Upon completion of all work, and as a condition to receiving final payment, furnish to the Engineer the following original, signed certificates and include copies of these certificates as part of the Operation and Maintenance manuals:
1. From the manufacturer's authorized representative, stating that authorized factory engineers have inspected and tested the operation of their respective equipment and found same to be installed in accordance with the manufacturer's requirements and to be in satisfactory operating condition. This certification shall be provided for all major equipment and for all complete systems. It is not required for other components unless specifically requested by the Engineer.
 2. Certificates of inspections, letters and notices from the appropriate government-authorized inspectional authorities stating that all portions of the work (indicate trade and responsibility) have been inspected and are installed in conformance with the applicable codes, laws, ordinances and referenced standards. In non-conformance notices are received, include the re-inspection certificate, letter of explanation, etc. as required to indicate complete conformance. Provide written evidence of all variations, exceptions, variances, etc. given by the inspectors.
 3. Certificate from the installing firm responsible for the work (indicate trade and responsibility) signed by an authorized officer or owner of the Firm and the Foreman or Project Manager in charge, stating that to the best of the signer's knowledge and belief that the project (indicate project name and address) has been installed in compliance with the Contract Plans, Specifications and Addenda, and all applicable codes and laws, ordinances and referenced standards. Where subcontractors perform a portion of the work of this Section, include certificates from them.
- D. Should Engineer observe and find Work incomplete, the review will be promptly suspended and written notification will be provided through the General Contractor.
- E. Complete Work, remedy deficiencies and send a second certification of final completion.
- F. Engineer shall, upon receipt of a second certification of completion, make a second review and provide notification in writing through the General Contractor, listing observed deficiencies.
- G. When Engineer finds work complete, close-out submittals will be considered.

END OF SECTION