SECTION 230000 - GENERAL REQUIREMENTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Division 01 Specifications, General and Supplemental Requirements apply to this section with additions and modifications specified herein.

B. Instructions to Bidders, Bidding Forms, Forms of Agreement between Owner and Contractor, Contract Award Date, Starting and Completion Dates, Conditions of the Contract, Insurance Requirements, and other Owner Requirements will be furnished separately by the Owner. These documents, as well as any addenda issued, shall form a part of these Specifications, and this Contractor shall consult them in detail for instructions pertaining to their work.

C. Each trade contractor shall receive all drawings and specification sections issued as part of the overall bid package. All contractors are to receive, review, and coordinate all of their work as shown or referenced on the other trade documents. All work shown or referenced on the other trade documents shall be included as part of the overall project scope for that particular discipline and trade.

1.2 SCOPE OF WORK:

A. These specifications and accompanying drawings are intended to cover the furnishing of all labor, material, and equipment and superintendence of the HVAC System for this project. They are also intended to cover performing all miscellaneous operations including excavations and backfilling, cutting, channeling, chasing and patching necessary for the installation of the HVAC systems, as shown on the drawings, as hereinafter specified, as directed by the Engineer or as may be required for a complete and fully functional HVAC installation.

B. It is the intent and purpose of these specifications and accompanying drawings to cover and include each item, all materials, machinery, apparatus, and labor necessary to properly install, equip, adjust, and put into perfect operation the respective portions of the installations specified and to so interconnect the various items or sections of the work as to form a complete and properly operating whole.

C. Drawings and specifications have been prepared with best knowledge of conditions available at the time of design and are intended to be complementary. What is called for by one shall be as binding as if called for by both. Where conflicts occur between drawings and specifications, or between the HVAC documents and the documents of other disciplines, the situation shall be brought to the attention of the Design Professional before the work in question is installed. In case of conflict between provisions of the Specifications or between the drawings and the specifications, the more stringent requirement shall govern. Where a requirement is applied to a specific product, condition, system or Specification Section which conflicts with a more general requirement elsewhere, the specific shall supersede the general. If any obscurities or discrepancies exist, they shall be brought to the attention of the Design Professional before bids

are submitted. If they are not discovered before bids are submitted, the Design Professional shall be notified and shall render a decision. This decision shall be final.

D. Any equipment, apparatus, machinery, material and small items not mentioned in detail, and labor not hereinafter specifically mentioned, which may be found necessary to complete or perfect any portion of installation in a substantial manner, and in compliance with the requirements stated, implied or intended in these specifications shall be furnished without extra cost. This shall include all materials, devices or methods peculiar to the machinery, equipment, apparatus, or systems furnished and installed as part of the HVAC work, and shall include major components if so required.

E. The general arrangement of piping, ductwork and equipment shall be as identified on the contract drawings. Carefully examine all contract drawings and be responsible for the proper fitting of materials and equipment in each location as indicated. Inasmuch as the drawings are generally diagrammatic, due to their small scale, it is not possible to indicate all offsets, fittings and accessories, as may be required in the final installation. Carefully investigate the site, structural, and finish conditions affecting their work and arrange such work accordingly, providing such fittings and accessories as may be required to meet such conditions, at no additional cost to the Owner. The right to make any reasonable change in location of apparatus, equipment, outlets or routing of conduit and wiring, up to the time of roughing-in, is reserved by the Design Professional without involving any additional expense to the Owner.

F. Should a bidder find discrepancies in or omissions from the drawings or specifications they shall notify the Design Professional before submitting their bid proposal. The Design Professional shall then send written instructions, via Addendum, to all known bidders. Oral instructions shall not be binding to either the Design Professional or the Owner.

G. In the case of discrepancies or conflicts between the Drawings and Specifications, typically the Drawings will take precedence in the case of quantitative issues, while the Specifications will take precedence for qualitative issues; or as specified in other Divisions; however, when the scale and date of the Drawings are the same, or when a discrepancy exists within the Documents and specific written direction cannot be obtained from the Design Professional, Bidders shall include the most stringent requirements. Obtain written clarification from the Engineer prior to installation.

H. Any such items not brought to the attention of the Design Professional prior to submission of the bids shall be subject to the interpretation of the Design Professional. All such interpretations shall be accepted by the Contractor and shall be incorporated into the construction in a timely manner, at no additional cost to the contract.

I. These Specifications are arranged in accordance with the MasterFormat 2016, 35 Division format. The Specification is to be read as a whole. Items or work called for on one paragraph or Section, shall be applicable to the entire work, unless specifically indicated otherwise. Specific contract scopes shall be as determined by the General Contractor or Construction Manager.

J. The following are definitions of words found in the various Sections of Divisions 23 and on the associated Mechanical drawings:

1. “Concealed” shall indicate hidden from normal sight in furred spaces, shafts, ceiling spaces, walls and partitions.

2. "Exposed" shall indicate work normally visible, including work in Mechanical or Electrical equipment rooms, tunnels, and similar spaces.
3. "Provide" (and tenses of "provide") – shall indicate "supply and install, complete in all respects, for a complete and fully functional installation."
4. "Install" (and tenses of "install") – shall indicate "secure in position, make all final connections complete, test, verify and certify for a complete and fully functional installation."
5. "Furnish" (and tenses of "furnish") – shall indicate "supply only, complete with all required accessories, mounting hardware, etc., for installation by others, or as spare "attic" stock for the Owner's future use."
6. "Engineer" shall indicate person, firm or Corporation representing the Owner, and identified as such in the Contract Documents. The terms "Engineer" and "Architect" may be used interchangeably throughout the documents.
7. "Authority Having Jurisdiction (AHJ)" shall indicate the organization, office, or individual responsible for enforcing the requirements of the applicable codes or standards in the location where the project is to be constructed.
8. "BAS" shall indicate Building Automation System and which shall also refer to by equivalent to references to "ATC" – Automatic Temperature Controls, "BMS" – Building Management System or "FMS" – Facility Management System. Any and all of these terms and acronyms may be used interchangeably to refer to the same functional system, specified under Divisions 21 - 25.

1.3 LAWS, REGULATIONS AND CODES:

A. Perform all work in strict compliance with all laws, regulations, and/or codes applying, including all Federal, State and local codes and any other authority having jurisdiction. Wherever drawings or specifications conflict with such regulations they shall be made to conform, and approval of the Design Professional obtained on such changes as may be involved.

1.4 QUALITY ASSURANCE:

A. Comply with the requirements of the following codes and/or standards:

1. ASHRAE
2. ANSI
3. ASME
4. ASTM
5. UL
6. NEMA
7. AMCA
8. NFPA
9. ARI
10. NEC
11. IBC 2018
12. IMC 2018
13. IECC 2018

B. All packaged equipment shall be independently Third Party labeled as a system for its intended use by a Nationally Recognized Testing Laboratory (NRTL) in accordance with the OSHA Federal Regulations 29CFR1910.303 and .399, as well as NFPA Pamphlet #70 and National Electric Code (NEC), Article 90-7.

1.5 PERMITS, FEES, AND CERTIFICATES OF APPROVAL:

A. Unless stated otherwise in General Conditions or Division 01, obtain and pay for all permits, fees, and licenses required, including those of utilities and Agencies. Provide copies to Design Professional in the quantity requested.

B. "Fees" shall include connection charges construction costs, and other such charges by utility companies or service providers. Ascertain such charges during bidding period and include bid price.

1.6 ALTERNATE PRICES:

A. Refer to Division 01 Sections for list of Alternate Prices being requested for this project, and if they are to be Add or Deduct alternates.

B. Where Alternate Prices are solicited, the alternate price shall include all work reasonably associated with the work to be priced as an alternate. Base bid conditions shall provide a complete, and fully functional installation, less the work associated with the alternate price.

1.7 RECORD DRAWINGS:

A. Throughout the construction keep an accurate, up-to-date record of all deviations of the work between that as shown on the drawings and that which is actually installed.

B. Obtain a complete set of prints of the Mechanical drawings and note changes thereon. The design professional will provide the CAD files or Revit model for the contractor's use. Make a complete record in a neat and accurate manner, of all changes and revisions to original design which exist in completed work. As-Built markups shall be updated on a daily basis.

C. Submit As-Built documents in electronic CAD file format. The project design files will be provided to the Contractor by the Design Professional following proper execution of the Document Release and Indemnity Form as provided by the Design Professional. The electronic files returned by the Contractor shall be fully compatible with the native AutoCAD (*.dwg file format) software used by the Design Professional to create the original documents. In addition, submit a complete set of drawings in PDF format.

D. The cost of preparing these record drawings shall be borne by the Contractor. When all revisions showing the work as finally installed are made, the prints and CAD files shall be submitted for review and approval by the Design Professional.

E. Record drawings shall be delivered to Owner within 30 days of project Substantial Completion.

1.8 OPERATION AND MAINTENANCE MANUALS:

A. Provide for the Owner's Use one (1) hard copy printed version and one (1) electronic copies in PDF format of a facility Operation and Maintenance Manual.

1. Each hard copy Manual shall be bound in an extra heavy duty three-ring loose-leaf binder with the following title lettered on the front "Record and Information Manual (insert name of project)". No sheets larger than 8-1/2" x 11" shall be used, except sheets that may be neatly folded to 8-1/2" x 11" and used as a pullout.
2. Each electronic format Manual shall be provided as a single .PDF file, fully bookmarked and indexed, containing all Owner's Manual data and project drawings.

B. Provide the following information in each Manual:

1. Cuts of all equipment with manufacturer's technical specifications. Material shall be manufacturer's brochures, catalog cuts, parts lists, wiring diagrams, etc. Also include approved shop drawings.
2. Operation, Maintenance and Servicing Procedures. Include frequency of inspection, cleaning and adjusting and other attention as may be required in accordance with manufacturer's instructions.
3. Copy of project Warranty.
4. Contact name, telephone number and email address for obtaining replacement parts and service for all equipment.
5. Copy of all individual equipment warranties.
6. Copies of all required Test Reports.
7. USB drive with all Special Systems drawings in both PDF and editable format.
8. Electronic copy of all Owners Instruction and Training Sessions.

C. Furnish qualified personnel to instruct the Owner's personnel in the maintenance and operation of all equipment and systems. Instructing personnel shall remain on the job continuously during working hours until such instruction is complete, but not less than 16 hours.

D. A video recording in digital format of the operator training session shall be made during this training period and the digital video submitted to the Owner with the Operation and Maintenance Manuals.

1.9 WARRANTY:

A. The material and workmanship of all parts of the mechanical installations specified herein and shown on the drawings shall be warranted unconditionally for a period of **one (1) year** from date of **Project** Substantial Completion against mechanical and electrical defects arising from faulty materials or workmanship. Either replacement or repairs shall be made promptly on any defective materials or workmanship without charge for materials, equipment or labor during that period.

B. Manufacturer's warranties on equipment provided under this contract shall be included in the operating and maintenance manuals.

C. See specification section regarding restrictions on Early Use of HVAC Equipment.

1.10 CORRECTION OF WORK AFTER FINAL PAYMENT AND WARRANTY:

A. This article is supplementary to Warranty Provisions of Division 01 and General Conditions.

B. Final payment shall not relieve the Contractor of responsibility for correction of faulty equipment, materials and workmanship and, unless otherwise specified, they shall remedy any defects due thereto and pay for damage to other work resulting therefrom, which shall appear within the warranty period specified above.

C. Include warranties by the respective equipment manufacturers which shall be subject to the terms and time limits defined under these Divisions of Specifications.

D. Warranties furnished by Sub-Contractor and/or equipment manufacturers shall be counter-signed by the related Prime Contractor for joint and/or individual responsibility for subject item.

E. Manufacturers' equipment guarantees or warranties extending beyond the warranty period described herein shall be transferred to the Owner along with the Contractor's warranties.

1.11 COMMISSIONING:

A. Commissioning: Division 23 Contractors and vendors shall be part of a total building and system commissioning effort as conducted by the Commissioning Agent. Each contractor shall provide a technician and tools required to assist and facilitate the commissioning agent, as outlined by the commissioning plan. Where applicable and required, the contractor shall secure and pay for a factory technician to be part of the startup, testing and commissioning team and efforts. Full scope of work and all related responsibilities will be defined in Commissioning documentation.

1. All equipment shall be commissioned, and the operation of that equipment shall be checked by the installing contractor. Specific systems shall be commissioned when more than one contractor is involved in the installation or there is multiple system interface and control involved with that piece of equipment.
2. The contractors shall check and verify all equipment nameplate data against the design parameters, prior to installation.
3. The contractors shall submit a Spare Parts List for all equipment in the Maintenance and Operations Manuals to include, but not limited to the following:

    a. Part Numbers.
    b. Part and Equipment Description.
    c. Quantity of Parts Required.
    d. Lubrication Requirements.
    e. Full Warranty Information.
    f. Complete Operation and Maintenance Manuals.

B. Provide factory trained technician after successful startup, for on-site support. Allow for five (5) days on-site for this. These days may not be consecutive.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT:

A. All installed materials and equipment shall be new and the best of their kind and shall conform to the grade, quality and standards specified herein.

B. Unless otherwise specifically stated, all materials and equipment offered under these specifications shall be limited to products regularly produced and recommended by the manufacturer for the service intended. This material and equipment shall have capacities and ratings sufficient to amply meet the requirements of the project. The capacities and ratings shall be in accord with engineering data or other comprehensive literature made available to the public by the manufacturer and in effect at the time of opening of bids.

C. Equipment shall be installed in accordance with manufacturer's instructions for type and quality of each piece of equipment used. These instructions shall be obtained from the manufacturer and shall be considered part of these specifications. Type, capacity and application of equipment shall be guaranteed suitable to operate satisfactorily. No experimental material or equipment shall be permitted.

2.2 WORK INCLUDED:

A. In addition to work described above under WORK DESCRIPTION, the work shall include but not necessarily be limited to the following:

1. Furnish and install all new scope as noted herein and shown on drawings.
2. Rigging of equipment and materials related to the HVAC Work.
3. Concrete work as specified hereinafter.
4. Excavation and backfill.
5. Mounting of duct smoke detectors furnished under Division 28.
6. Ductwork and piping leak testing.
7. Pipe, valve and equipment marking and tags. Painting as noted herein.
8. Duct cleaning.
9. Test, adjust and balancing of all ductwork, piping and equipment.
10. Any and all shutdowns shall be scheduled with the Owner and performed at such times as the Owner may direct. Required premium time shall be included in the Contractors bid.
11. Where the specification requires testing, factory and/or field start-up, commissioning, adjustments, warranty or other activity, such requirements shall apply to each individual phase of the work.
12. Support of independent commissioning agent retained by Owner.
13. Where work of one phase extends from or interfaces with previous work, services for the latter phase shall include previously installed components. At the end of all work all such systems or equipment shall be tested or adjusted in their entirety in completed form, even if tests are redundant with previous phases.
14. Instruction and equipment manuals. Instruction of Owners representatives.

2.3 EXCAVATION AND BACKFILL:

A. All excavation and backfill required for HVAC work will be done by Others. Refer to Section _____.

B. Provide to the appropriate trade all information required to properly perform the excavation work in a timely and coordinated manner.

OR

2.4 EXCAVATION AND BACKFILL:

A. Provide all excavation and backfill required for work performed under this Contract.

B. Excavation is unclassified and includes without limitation the excavation and removal of all material encountered.

C. Backfill with clean, rock and debris-free earth. Use hand shovel to work backfill around conduit or encasement and against sides of trench. Mechanically tamp backfill to density of undisturbed adjacent earth. Remove excess excavated material from site.

D. Provide all shoring, bracing, barricades, dewatering, etc.

E. All surfaces disturbed by earthwork shall be restored to their original condition using materials and methods to match the existing surfaces.

2.5 PUMPING:

A. Provide pumping equipment to pump all water to prevent it from collecting in trenches, basement areas, and any other excavations necessary to carry out contract requirements. Prepare run-off trenches as required to pump water into and use surplus earth to form dam at top of excavation to run back surface water.

2.6 CHASES AND OPENINGS:

A. Provide information to the appropriate trades regarding size and location of all openings and chases as required for the installation of this HVAC Work.

B. Patching and repair of finishes will be by the General Contractor.

C. Provide sleeves for pipes passing through poured concrete decks, footings, walls, etc. Cut all openings for piping passing through precast concrete or existing concrete or masonry. Such holes shall be cut with core drill or similar equipment. They shall not be cut with hammer and chisel, or with any power tool depending on impact for its cutting power.

2.7 CUTTING AND PATCHING:

A. Provide all cutting and patching required for work performed under this Contract. No holes

may be cut or drilled in structural members without prior approval of Owner's Representative. Cutting shall be done by mechanics skilled in their respective trades.

B. No cutting that may impair the strength of the building construction shall be done. No holes may be drilled in or attachments welded to the beams or other structural members without prior approval from the Owner's Representative. All work shall be done by mechanics skilled in their trade.

C. All patching shall be done in a manner to match appearances and quality of existing surfaces.

D. Provide sleeves for pipes passing through poured concrete decks, footings, walls, etc. Cut all openings for piping and ductwork passing through precast concrete or existing concrete masonry. Such holes shall be cut with core drill or similar equipment. They shall not be cut with hammer or chisel, or with any power tool depending on impact for its cutting power.

E. For holes and openings in pre-cast concrete, 2-1/2" round and above, or 2-1/2" and above on longest side, prepare a drawing for the Design Professional's approval for same to be pre-cast in the factory; for holes and openings smaller than above, prepare a drawing for the Design Professional's approval for same to be cut, cored or drilled in the field by the HVAC trade.

1. Particular attention shall be given to the requirements of the NEC for testing and labeling cables for use in plenums, risers, and other air-handling spaces.

2.8 FLASHING AND ROOFING WORK:

A. The Contractor shall perform all cutting, patching and sealing of existing roofs as required for the installation of all work under this Contract.

B. The contractor bears the complete responsibility for maintaining and obtaining the watertight integrity of the affected areas of the roofs both during and after the completion of construction.

C. The Contractor shall provide all base flashings, counter flashings, and hot applied roofing materials necessary to properly flash and seal the roofs as required and to prevent any water or moisture leakage whatsoever from occurring as a result of this work.

D. Unless noted otherwise, all flashings shall be minimum 24-gauge galvanized steel. Base flashings shall have minimum 4" roof flanges on all sides. Flanges of all base flashings shall be secured and stripped into existing roofing in accordance with the best practices and methods of the roofing trade for a watertight installation.

E. All joints and seams of all flashings shall be continuously soldered.

F. After installation, all exposed metal surfaces of base flashings shall be given two (2) applications of roofing coating.

G. All roofing work shall be performed by first class mechanics experienced in the roofing trade.

H. Contractor must exercise extreme care so as not to damage existing roofs while working thereon and they shall provide protection planking and plywood as required to achieve this result. Any damage to the existing roofs and their watertight integrity caused as a result of

work being performed under this Contract shall be properly repaired by the Contractor to the satisfaction of and at no cost to the Owner.

I. Refer to drawings for additional flashing details and roofing work required.

2.9 SUBSTITUTIONS:

A. Equipment may be shown or specified in several ways:

1. Manufacturer and catalogue or model number with the words "no substitutions," "no equal," "(manufacturer) only," or words of similar respect. Contractor shall furnish the specified item.
2. Several manufacturers and model numbers listed; or one manufacturer and model number, followed by "equals by (mfr A), (mfr B), (mfr C)," or words of similar respect.

    a. If one of the manufacturers is listed on the drawings, that manufacturer shall be considered the basis of design. If none is so listed, the first manufacturer named in the Specification shall be considered the basis of design.
    b. Where manufacturer's or supplier's name, style and catalog numbers are mentioned in the description of material and equipment in the specifications or on the drawings, it is to be understood that they are for the purpose of setting a standard.
    c. If Contractor elects to furnish equipment other than the basis of design, they shall verify capacities, physical size, weight, electrical requirements, methods of connection to other parts of the system, and all other relevant data. Contractor shall be responsible for informing the Design Professional of all changes required to other equipment, spaces, structure or systems in order to install the substituted equipment. They shall furnish all required shop drawings or sketches required for Design Professional to evaluate the required changes and shall be responsible for all costs associated with such changes, including costs of design or engineering, if such are necessary, and costs of other trades.
    d. Accompany the request for substitution review with a table of comparisons listing pertinent features of both the specified and proposed materials including performance data, weight, material of construction, overall length, width, height dimensions, space required for replacement or maintenance access, motor type, horsepower, voltage, phase service factor, and noise levels. Review of proposed substitution will not be made until receipt of the complete comparison tabulation.

3. Where manufacturer's or supplier's names are listed in conjunction with the manufacturer or supplier that is basis of design, they are given to approve the firm name only. Equipment or material submitted by such firms must meet the detailed technical specifications written for the respective item. Contractor shall be responsible for verifying capacities, physical sizes, weights, electrical requirements, and methods of connection to other parts of the system, etc. Contractor shall furnish all required shop drawings for equipment, and for its connection and installation.

B. If any substituted items are submitted after contracts have been awarded, and there is any question of equality of such items, samples may be required to be submitted both for the item specified and that to be substituted, or, further proof of equality may be required to the entire satisfaction of the Design Professional. In no case shall additional remuneration be allowed because of the rejection of a substitute.

C. When the equipment is relocated to a place other than that shown on the drawings, or when equipment other than that specified is used, the Contractor shall pay the extra cost of required revisions such as structural steel, concrete, electrical, piping, etc.

D. The Design Professional's costs to evaluate substitutions and to revise Drawings and Specifications because of substitutions will be paid by the Contractor.

2.10 SHOP DRAWINGS:

A. Refer also to Division 01.

B. Furnish shop drawings, catalog cuts, performance data and other required data to the Design Professional for approval for all material and equipment specified hereinafter. Sufficient data shall be submitted to show compliance with the requirements of the plans and specifications. All shop drawings submitted shall be first checked and corrected before submitting for approval. Approval for shop drawings by the Design Professional will not relieve the Contractor from responsibility for errors or omissions therein. All such errors or omissions must be made good by the Contractor irrespective of any approval by the Design Professional.

C. It is the responsibility of the manufacturer’s representative and the installing contractor to thoroughly review all shop drawing equipment submittals and state in writing that the products meet or exceed the design specifications and design intent as indicated on the contract documents, prior to submitting them for review by the engineer.

D. The General Contractor or Construction Manager shall review and stamp all shop drawings noting their review process has taken place and that the shop drawings are in compliance with the design documents, prior to submitting the for review by the engineer. Any shop drawings found to not be in compliance shall be returned to the contractor stating such, with a copy of the statement (only) forwarded to the engineer.

E. On submissions beyond the initial one, clearly identify all of the changes made from the initial submittal those requested by the Design Professional. The Design Professional will review only those changes they requested and those identified by the Contractor.

F. The Engineer will review three submissions (one original submission and up to two revised submissions) on any single component requested for review. If the contractor and/or vendor fail to comply with the drawings, specifications, and/or review comments and additional submissions are required, the cost for review and processing of those submissions will be borne by the contractor.

G. The design documents are based and coordinated on the scheduled manufacturers. Any substitutions of products or materials (from those approved and listed in the specifications) must be thoroughly coordinated by the submitting contractor. This includes but is not limited to power, space, structural, control and performance requirements.

H. Shop drawings required shall include, but not necessarily be limited to, the following:

1. Shop drawings, cuts and catalogue information showing appearance, dimensions, performance, weight, etc., of all equipment, appurtenances, etc.
2. Schedules of all materials showing type and manufacturer.

3. Wiring diagrams and schematics for equipment.
4. All special equipment and systems.
5. Any special constructions.
6. Other shop drawings as may be requested.
7. Ductwork shop fabrication drawings. See also the requirements in Part Three of this Specification Section.

I. Digital files of mechanical work will not be provided for the purpose of shop drawing preparation. Digital files of architectural plans, elevations, sections, etc. may be available for background purposes; it is the responsibility of the Contractor to confirm availability prior to bid.

J. Shop drawings shall be submitted in a timely manner, taking due account of time requirements for processing, correcting and distributing the shop drawings to all persons or trades requiring the information, as well as time required for manufacture of the equipment. Design Professional will not be responsible for construction delays resulting from late submission of shop drawings, nor for delays caused by the need to correct and resubmit shop drawings which were not correct, which involved substituted equipment, or otherwise required review, correction and resubmission.

K. If Contractor elects to proceed to install equipment for which approved Shop Drawings have not been received, they do so at their own risk; Design Professional is not obligated to accept such equipment or work, nor will Design Professional be liable for claimed costs or delays required by correction of such work.

L. Identify each submittal, including shop drawings, catalog data, test reports, operation and maintenance manuals, and record documents, with the following data:

1. Buyer's name.
2. Project name.
3. Project location.
4. Buyer's purchase order number.
5. Reference specification order number.
6. Name of contractor making the submittal.
7. Revision level of submittal and date of revision.

M. For equipment, provide the following information on each submittal:

1. Equipment tag number.
2. Equipment description.
3. Equipment manufacturer's contact information.
4. Local equipment representative's contact information.

N. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristic, finishes for materials, and installation and startup instructions for each type of product indicated.

1. Each control device labeled with setting or adjustable range of control.

O. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Schematic flow diagrams showing all controlled equipment and control devices.
2. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.
3. Details of control panel faces, including controls, instruments, and labeling.
4. Written description of sequence of operation.
5. Trunk cable schematic showing programmable control unit locations and trunk data conductors.
6. Listing of connected data points, including connected control unit and input device.
7. System graphics indicating monitored systems, data point addresses, and operator notations.
8. System configuration showing peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.

P. Shop Drawings shall be submitted and shall consist of a complete list of equipment and materials, including manufacturer's descriptive and technical literature, catalog cuts, and installation instructions. Shop drawings shall also contain complete wiring, routing, schematic diagrams, tag number of devices, software descriptions, calculations, and any other details required to demonstrate that the system will function properly. Drawings shall show proposed layout and installation of all equipment and the relationship to other parts of the work.

Q. Shop Drawings shall be approved before any equipment is installed. Therefore, shop drawings must be submitted in time for review so that all installations can be completed per the project completion schedule. Ten (10) working days shall be allowed for submittals to be reviewed by the Engineer.

R. All drawings shall be reviewed after the final system checkout and updated or corrected to provide "as-built" drawings to show exact installation. All shop drawings will be acknowledged in writing before installation is started and again after the final checkout of the system. The system will not be considered complete until the "as-built" drawings have received their final approval. The Contractor shall deliver a complete set of "as-built" drawings.

S. On submissions beyond the initial one, clearly identify changes made from the initial submittal other than those requested by the Design Professional. The Design Professional will review only those changes they requested and those identified by the Contractor.

Shop Drawing Review Comment Definitions

A> No Exception Taken:

The shop drawing or equipment submittal as submitted is approved without exception. No changes or corrections required. The materials, equipment or system submitted can be released for fabrication and construction. No Further Submission Required.

B> Make Corrections Noted:

The shop drawing or equipment submittal as submitted is not completely correct but is approved as noted. Make the corrections noted on the shop drawing or submittal. The materials, equipment or system submitted can be released for fabrication and construction once the corrections have been made. The submittal must be corrected and resubmitted for record unless noted by "E: Resubmit". See "E: Resubmit definition below.

C> Submit Specified Item:

The shop drawing or equipment submittal as submitted is missing a component of the system that it represents or is not of the approved and specified manufacturers. Submit the missing or incorrect item. The materials, equipment or system submitted cannot be released for fabrication and construction.

D> No Further Submission Required:

The shop drawing or equipment submittal as submitted is approved as noted. No changes or corrections required. The materials, equipment or system submitted can be released for fabrication and construction. No Further Submission Required.

E> Resubmit:

The shop drawing or equipment submittal as submitted is not approved. The shop drawing or equipment submittal needs significant corrections and does require another submission to verify that the comments and changes have been incorporated. Make the corrections noted on the shop drawing or submittal. The materials, equipment or system submitted cannot be released for fabrication and construction.

F> Rejected:

The shop drawing or equipment submitted is not as specified or a non-approved manufacturer or product and rejected.

G> Resubmit for Record Only:

Make the corrections noted on the shop drawing or submittal. The shop drawing or equipment submittal as submitted is approved with minor exception. Changes or corrections are required. The materials, equipment or system submitted can be released for fabrication and construction.

PART 3 - EXECUTION

3.1 VISIT TO SITE:

A. Before submitting bid, visit the site of the work and be thoroughly familiarized with the conditions affecting the work. No extra payment will be allowed on account of extra work made necessary by failure to do so.

3.2 WORKMANSHIP:

A. All work shall be installed in a first class, neat and workmanlike manner by mechanics skilled in the trade involved. All details of the installation shall be mechanically correct. Should the Design Professional direct removal, change, or installation of any equipments or systems not installed in a neat and workmanlike manner, such changes shall be made by the HVAC Contractor at no expense to the Owner.

B. Equipment shall be installed in strict accordance with manufacturer's instructions for type and capacity of each piece of equipment used. The Contractor shall obtain these instructions from the manufacturer and these instructions shall be considered part of these Specifications.

C. Drawings are generally indicative of the work to be installed, but do not indicate all bends, fittings, and specialties which may be required, or the exact locations of all piping and ductwork. Contractor shall investigate structure and finish conditions affecting their work and arrange their work; accordingly, furnishing such fittings as may be required to meet such conditions. Contractor is responsible for exercising proper judgment to arrange their work and materials so as to avoid interference with other trades.

1. Riser diagrams and schematics generally indicate equipment to be used in various systems involved. This information may or may not be duplicated on the plans, but equipment shown on either plans or riser diagrams and schematics shall be provided as if shown on both.
2. All grades, elevations, dimensions and clearances of equipment shown on drawings are approximate and shall be verified at site.
3. Where work or equipment is referred to in singular terms, such reference shall be deemed to apply to as many items of work or equipment as required to complete entire installation.

3.3 LINES AND GRADES:

A. Lay out work and establish heights and grades for work in strict accordance with the intent expressed by the drawings and all the physical conditions at the building and be responsible for the accuracy of same.

3.4 FIELD MEASUREMENTS:

A. Before ordering any material or doing any work, verify all measurements at the building and site and be responsible for the correctness of same. No extra compensation will be allowed on account of differences between actual dimensions and measurements and those indicated on the drawings. Any difference which may be found shall be submitted to the Design Professional for consideration before proceeding any further with the work.

3.5 DELIVERY OF EQUIPMENT:

A. Be responsible for delivery of equipment, unload and store in a manner not to interfere with the operation of other trades. Additional expense incurred because of equipment or material delivery delays shall be assumed by the responsible Contractor.

3.6 RESTRICTIONS ON EARLY USE OF HVAC EQUIPMENT:

A. The HVAC equipment provided under this contract shall not be operated prior to the completion of construction of the building for reasons other than testing and balancing of the systems, unless specifically directed and/or approved by the Owner. This specifically prohibits the use of permanent equipment for the purposes of ventilating, heating and dehumidifying the building while under construction.

B. Should a contractor choose to use any component of the permanent HVAC system (i.e. chillers, pumps, air handlers, fan coil units, etc.) for purposes other than stated above, they shall assume full responsibility for replacing or repairing any equipment damaged as a result of the use and pay all costs associated with the action required to make the equipment in "like new" conditions at the end of the project. This includes cleaning of ducts and coils, replacement of motors, extension of warranties, payment of design professional fees required to investigate and enforce this requirement, and the correction of any other detrimental conditions which is determined by the design professionals to be related to the early use of the equipment.

C. Should the early use of equipment result in manufacturer's warranty being void, the contractor shall assume the cost of furnishing an equivalent warranty to the owner.

D. Should fan motors be operated during construction, any motor determined by the owner or design professional to be exposed to airborne construction dust, such as generated by drywall sanding, shall be inspected by an independent 3rd party for damage. The costs of all required corrective actions shall be borne by the contractor responsible for the operation of the equipment.

3.7 PROTECTION OF WORK:

A. All work, equipment and materials shall be protected at all times.

B. All piping openings shall be closed with caps or plugs during installation. All equipment shall be tightly covered and protected against dirt, water, plaster, paint and other foreign material or mechanical injury during entire progress of installation. Make good all damage caused either directly or indirectly by workmen employed to fulfill requirements of the HVAC Work.

C. Acoustically lined ductwork shall at all times be protected from weather.

3.8 REMOVAL OF RUBBISH:

A. During the course of construction, periodically remove from the premises all rubbish resulting from work of this trade so as to prevent its accumulation. At the completion of the work contemplated under these Specifications remove from the building and site all rubbish and accumulated materials of whatever nature not caused by the other trades and leave work, and equipment free of all foreign matter including plaster, cement, and paint and leave in a clean, orderly, acceptable and usable condition

3.9 COORDINATION WITH OTHER TRADES:

A. Work in conjunction with each of the other trades to facilitate proper and intelligent execution of work with minimum interference.

B. Carefully examine all architectural and structural drawings for the building and drawings for electrical trade and other mechanical trades and be responsible for the proper fitting of all material and equipment into the building as planned and without interference with other piping, ductwork, conduit or equipment. Proper judgment shall be exercised to secure best possible headroom, door and window clearance, and space conditions throughout; to secure neat arrangement for piping, equipment and conduit: and to overcome all local difficulties and interferences to best advantage. Approval for any and all changes to plans and specifications which may thus be incurred shall be obtained from the Design Professional before proceeding.

C. Contractor shall prepare preliminary sheet-metal shop drawings suitable for use in coordinating their work with the work of other trades. The Mechanical Contractor shall prepare and furnish CAD or 3D BIM files of drawings at 3/8" = 1'-0" scale illustrating the coordination with all trades. Drawing shall indicate equipment access requirements, piping, ductwork and conduit in relation to all structural elements of the construction, including floor elevations; steel locations, size, and elevations; partitions locations; door locations and direction of swing; and all other information required to assure coordination of the electrical, sheet-metal and piping trades and fire protection in relation to the Architectural function of the project. Coordination meetings shall be held under the supervision of the Owner's Construction Manager and General Contractor. Each trade shall have proper representation at all coordination meetings for the purpose of detailing, on a print of the coordinated drawing mentioned above, the exact location and routing of their work. After the conclusion of the coordination at the working meetings, each trade shall sign the coordinated print, copies of which shall be distributed by the GC to all contractors and parties concerned including the Owner. A print of each final coordination CAD drawing with the participants contractor’s “signoff” signatures appended shall be submitted to the design professional for record.

D. If contractor installs work so as to cause interference with work of other trades, they shall make necessary changes in work to correct the condition without extra charge.

E. Dimensional layout plans of equipment rooms shall be made showing all bases, pads and inertia blocks required for mechanical equipment. Include dimensions of bases, bolt layouts, details, etc.

F. Contractor shall furnish all necessary templates, patterns, etc. for installing work and for purpose of making adjoining work conform, furnish setting plans and shop details to other trades as required.

G. The drawings and model development for the project is based on specific equipment and materials, as the Basis of Design. This equipment and materials have been developed, designed, and graphically represented within the model, such that the quality, size, shape, location and orientation can be determined and measured. Non-graphic information may also be attached to the model element. The model does not fully resolve all minor spatial conflicts. The Contractor may utilize the model in developing his/her construction level drawings as well as shop drawings and submittals. The contractor shall update the spatial requirements of the equipment and materials, based on his/her final approved vendor selections and interdisciplinary coordination.

3.10 COORDINATION OF CONTROL EQUIPMENT:

A. The HVAC Contractor shall furnish all starters, push buttons for local or remote control, controllers, pressure switches, aquastats, thermostats, float switches or similar items together with all appurtenances and accessories required to operate the equipment furnished under these specifications and necessary to perform the operating functions as specified, shown on the drawings, or otherwise required.

B. Refer to Schedule of Control Equipment on Drawings for type of controls required. The Electrical Contractor will mount and provide power-wiring for all starters and will furnish and install all other safety switches or other line-disconnecting or protective devices. Where the starter and/or safety switch is an integral part of the equipment assembly, the assembly shall be furnished with the wiring complete between starter, controller and motor and the Electrical Contractor will make power connections only.

C. All control wiring to automatic-operated switches, pressure switches, aquastats or other devices which actuate the starter or other items associated with the systems shall be furnished, installed and wired by the HVAC Contractor. The Electrical Contractor will supply 120V electric power to the control panels for these special systems to the extent shown on Electrical Drawings. All other wiring (including additional power circuit if required) shall be the responsibility of the HVAC Contractor.

D. The HVAC Contractor shall carefully check the current characteristics available to each location before ordering motors.

E. If procurement requirements necessitate a change in voltage, phase, horsepower or other characteristics of any motor, the HVAC Contractor shall obtain approval of such change from the Design Professional and shall be responsible for necessary arrangements for notifying the Electrical Contractor, and shall pay the costs, if any, required by the change, including Engineering costs.

F. All electrical equipment furnished and installed under this contract shall be furnished with full complement of control equipment, control wiring, conduit and all other items necessary for satisfactory operation.

G. The Electrical Contractor will complete all electrical power connections, through the disconnect and/or thermal cutouts, starter and motor terminals. They will be responsible for final power connections.

H. The Electrical Contractor will be responsible for proper rotation of three phase equipment.

I. All electrical work, equipment and material furnished under this Section shall be furnished and installed in accordance with Division 26 Electrical Specifications.

J. All panels, relays, terminal boxes, contactors, circuit breakers, safety switches, motor starters and similar items shall be identified by Name, Function and/or Control. Nameplates shall be at least 1" x 3" with characters not less than ¼". They shall be made of two laminated black plastic sheets bonded with a middle sheet of white plastic and characters engraved in one black sheet to the depth of the white plastic. A typewritten list of Nameplates shall be submitted to the Design Professional for approval before ordering same.

3.11 EXPANSION OF PIPING:

A. All piping connections shall be made so as to allow for perfect freedom of movement of piping during expansion and contraction, without springing or creating air pockets which will impair the flow of the water through the system. Install expansion loops as shown on the drawing or as required. Expansion loops shall be made with swing joints, bends or long offsets as necessary. Provide expansion guides.

3.12 ANCHORS AND GUIDES:

A. Anchors shall be provided where shown and/or required for the proper control of stress in piping due to expansion.

3.13 ACCESS:

A. All equipment requiring maintenance or adjustment must be accessible. Items located above ceilings shall be located above accessible portions of the ceiling or above access panels provided by this Contractor. Manufactured items with internal components requiring access (whether integral with the enclosure or not) shall be provided with access panels. Access panels shall be provided in ductwork where required for maintenance or adjustment of internal components.

3.14 SPARE FILTERS:

A. For all equipment provided with filters, this contractor shall provide spare filters to be installed after final acceptance of the systems. It is the responsibility of this contractor to install spare filters.

3.15 FIRE STOPPING:

A. All penetrations through fire-resistance-rated floor, fire resistance rated, floor/ceiling assemblies and roof construction and through fire-resistance-rated walls and partitions shall be fire stopped.

B. Penetrations to be fire stopped include both empty openings and those containing cables, pipes, ducts, conduits and any other items.

C. Fire rating of sealed penetrations shall meet or exceed the rating of the assembly being penetrated.

D. Materials shall be installed in accordance with manufacturer’s recommendations and their UL listing.

3.16 PREPARATION FOR TESTING AND BALANCING:

A. Review Contract Documents and submittals to verify that piping, instruments, thermowells, valves, ductwork, dampers, measurement and control devices, and access openings have been

provided in correct quantity and at correct locations to permit testing and balancing of air and hydronic systems under various operating conditions.

B. Provide V-belt drives or variable pitch sheaves for fans as indicated. Provide variable frequency drives as Work of Division 26. Replace variable pitch sheaves or initial fixed pitch sheaves with appropriate fixed pitch sheaves when correct speed (rpm) has been determined by Testing and Balancing Agency. Deliver variable-pitch sheaves and initial fixed pitch sheaves to Owner's Representative. Notify TAB Agency upon completion of sheave replacement.

C. Inform TAB Agency regarding major deviations from Contract Documents made to systems during construction and furnish one (1) complete set of Record Drawings, showing presence and location of balancing elements, volume dampers, air extractors and instrument ports, prior to start of TAB work.

D. Provide indicated Work and submit certification that each operation indicated is complete and in accordance with Contract Documents. Accomplish this Work before TAB work can start. Within 30 days of notification by Owner of award of Testing and Balancing Contract, submit schedule to complete following work:

1. Complete physical installation.
2. Pressure test air, and hydronic systems as required.
3. Clean, flush, fill and chemically treat hydronic systems as required. Provide temporary start-up strainers and replace with clean strainers after system cleaning as indicated.
4. Provide each air system with medium-efficiency disposable start-up filters. Replace filters one (1) time during construction. Replace with new specified filters upon acceptance of each system by Owner's Representative.
5. Test and operate prime movers, including fans, at full design load to verify adequate power, proper rotation, completed controls, operational auxiliaries, and complete overall installation.
6. Balance rotating equipment statically and dynamically.
7. Secure linkages.
8. Properly evacuate air from liquid systems. Install air vents at coils and at high points in systems whether or not expressly indicated and verify that they operate properly. Verify that expansion tanks are filled and in proper working order.
9. Verify that automatic control valves are in proper working order and location, that they are marked and installed with correct "NORMAL" positions as required, and that hand valves and balancing valves are positioned for full flow through equipment.
10. Verify that automatic control dampers are in proper working order and location, that they are marked and installed with "NORMAL" positions as required. Verify that balancing and shut-off dampers are positioned for full flow. Verify that equipment, terminal devices and distribution systems are completely and properly connected.

E. For each item of mechanical equipment, submit typed Data Register in non-yellowing, clear plastic binder, and securely attach it to associated equipment. Show operating temperature, pressure, flow rate, amperage, voltage, phase, frequency (Hz), rpm and brake horsepower {input power (kW), as appropriate.

F. Deliver to TAB Agency, for use until TAB work is complete, flow-indicating devices intended for use with permanently installed primary flow measuring devices. Calibrate permanently installed flow measuring devices and associated display instruments, thermometers, sensors and pressure gauges. Deliver documentation to TAB Agency to verify calibrations.

G. Submit schedule stating when each system is ready for TAB work to begin. Separate schedule by area, and mechanical system. Submit schedule within 30 days of Contract Award. Update schedule at least two (2) months in advance of scheduled start of TAB work.

H. Attend coordination meetings between TAB Agency, and Owner's Representative, conducted under guidance of Contractor. First meeting is approximately two (2) weeks before scheduled start of TAB work, as scheduled by Mechanical Contractor and approved by Owner's Representative.

I. Provide labor, material, tools and equipment to operate mechanical equipment and systems during TAB work, and for required adjustments, calibrations and repairs of automatic control devices or their components. Provide these services on each working day and without undue delay, as required by TAB Agency. Protect and operate equipment and systems during TAB work.

J. When requested by TAB Agency, furnish services of personnel to accompany TAB Agency when TAB work is being performed.

K. Make modifications at no additional cost and to satisfaction of Owner's Representative to rectify discrepancies reported by TAB Agency indicating non-compliance with Contract Documents.

END OF SECTION 2300000