Project Manual and
Specifications

Our Lady of Lady Victory
Parish Hall Package B

VOLUME 2

Diocese of Victoria
Victoria, Texas

Project #716-0114B
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Set No._____

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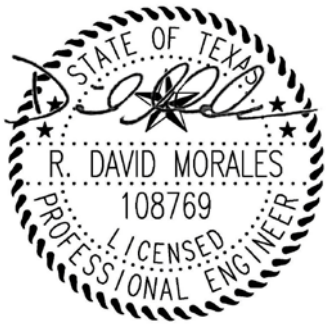

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SECTION 20 00 00
MECHANICAL AND ELECTRICAL SPECIFICATIONS (COMMON CONDITIONS)

1.1 GENERAL CONDITIONS

A. Sections of the Specifications covering general and supplemental conditions are a part of the contract and Contractors shall observe all of the requirements thereof, insofar as they pertain and are applicable to their respective work. Reference to Contractor or Contractors shall imply Mechanical (Plumbing and HVAC) and Electrical Contractors.

B. Contractors shall examine all Drawings and Specifications, visit the site of the proposed construction, become fully informed as to the extent and character of the work required, and make provisions for same in his bid. It will be assumed that the Contractor in submitting his bid has visited the premises and his bid covers all work necessary to properly install his work.

C. If any requirements of the Drawings and the Specifications appear to be difficult to perform, or if there is a question regarding performance, Contractor shall report same to the Architect during the bidding period. The right to make any reasonable change in the location of outlets, apparatus, and equipment up to the time of rough-in is reserved by the Architect without involving any additional expense.

D. If any discrepancies occur during construction between work being performed by the Contractor and work of other trades, it shall be the responsibility of the Contractor to notify the Architect immediately. Under no circumstances shall the Contractor proceed with any work conflicting with other trades until such time as the discrepancies have been corrected. In cases where interference develops, Architect shall decide which work is to be relocated regardless of which was first installed.

E. Contractor shall proceed with his work so as to conform to the progress of the work of other trades and not delay the project. Contractor shall complete all installations as soon as the conditions of the project will permit.

1.2 SCOPE OF WORK

A. Work to be done under this contract shall include the furnishing of all labor, materials, apparatus, and connections to complete, in finished operating condition, the work for Parish Hall Package B – Our Lady of Victory Catholic Church – Diocese of Victoria, Victoria, Texas.

B. Contractor shall take into account that deviations from routing and layout of new work indicated on the Drawings may be required to avoid interference with existing structure and facilities. Contractor shall be responsible for rerouting of existing conduit, piping, etc., to avoid interference with new work if deviations in routing of new work cannot be made to avoid interference with existing conditions. Wiring, piping, ductwork, etc., which serves loads or areas to remain

in use either temporarily or permanently will be rerouted as required and as directed to preserve continuity of service.

C. All items of labor, material, or equipment not required in detail by the Specifications or Drawings, but incidental to, or necessary for the complete installation and proper operation of all phases of work described herein, or reasonably implied in connection therewith, shall be furnished as if called for in detail by the Specifications or Drawings.

D. Existing underground utilities are not indicated on the Drawings. The Contractor shall be responsible for jobsite locating and protecting all existing underground utilities prior to trenching or pier drilling.

1.3 WORKMANSHIP

All labor shall be performed in the best and most workmanlike manner by mechanics skilled in their particular trades. All installations shall be complete in both effectiveness and appearance whether finally enclosed or left exposed. Architect reserves the right to direct the removal or replacement of any item which in his opinion shall not present a reasonable neat or workmanlike appearance, providing that same can be properly installed in an orderly way by usual method for such work. All specialties and appurtenances shall be installed to conform to the manufacturer's recommendations unless otherwise specified.

1.4 CODES, PERMITS, AND FEES

A. Entire installation shall be done in strict accordance with all local, state, and federal ordinances, codes, and regulations.

B. In the event there is a conflict between the Drawings and Specifications and the applicable codes, ordinances, and regulations, the codes, ordinances, and regulations requirements shall govern. However, if the contract requirements are in excess of these requirements and do not conflict with the requirements, the contract provisions shall govern. If any work indicated on the Drawings is in conflict with codes, ordinances and regulations, Contractor shall advise Architect at least one (1) week prior to bid date so that discrepancies may be corrected by an addendum to the Drawings and Specifications. Failure by the Contractor to advise of any discrepancies shall leave the Contractor fully and completely responsible for compliance with all applicable codes and requirements.

C. All work shall comply with Standards contained in applicable NFPA pamphlets, all as published by the NFPA (National Fire Protection Association).

D. Contractor shall obtain all permits and pay all fees necessary in connection with his work.

1.5 SAFETY STANDARDS

It shall be Contractor's sole responsibility to initiate, maintain, and supervise all safety precautions required by local, state, and federal laws, including OSHA (Occupational Health and Safety Administration) and trench safety laws.

1.6 MATERIALS AND EQUIPMENT

A. All materials and equipment furnished under this contract shall be in strict accordance with these Specifications, and shall be new. Equipment shall be of the latest or current products available. When two (2) or more articles of the same materials or equipment are required, the articles of each kind shall be standard products of a single reputable manufacturer. Electrical materials and equipment shall bear the label of UL (Underwriters Laboratories, Inc.).

B. All materials and equipment shall be clearly marked, stamped, or labeled for identification. Identification marks or labels shall be plainly visible for inspection and shall not be obscured or obliterated in any manner. Painting or covering shall not be done until so ordered by the Architect.

C. Contractor shall furnish to the Architect, within a reasonable time after award of contract, and prior to commencing any work, complete brochures of all materials and equipment which the Contractor proposes to furnish on the project. Data shall include descriptive literature, performance data, diagrams, capacity information, etc., to substantiate that proposed equipment physical size and capacity will meet all of the requirements of the Drawings and Specifications.

D. All data must be checked and any required changes indicated thereon by the Contractor, signed, and dated prior to furnishing same to the Architect for approval. Contractor's attention is directed that it is mandatory that he thoroughly review data prior to furnishing same to assure that equipment is in accordance with Drawings and Specifications and to assure prompt return of the data.

E. Each brochure shall be neatly organized into a single binder or electronic PDF file. In each brochure provide cover sheet identifying project name and location, Architect, Engineer, General Contractor, and Mechanical, Electrical, or Plumbing Contractor. Include Contractor's addresses and phone numbers. Provide adequate space for Architect's and Engineer's stamps. Provide quantity of submittal copies required by other sections of the Specifications.

F. If above information is not provided complete as specified above and within the allocated time, all equipment shall be furnished exactly as specified without any substitutions.

G. In furnishing data of proposed equipment and materials, Contractor must, in writing, specifically call to the attention of the Architect every deviation from the Contract Drawings and Specifications.

H. Review of data, drawings, etc., shall not be construed as releasing the Contractor from further responsibility, but rather as a means to coordinate the work and to aid in the proper selection and installation of the equipment. All material and equipment shall be subject to final acceptance by the Architect at the completion of the project.

1.7 WARRANTY

A. Any defects from defective or improper materials or faults arising from improper workmanship which may appear within a period of twelve (12) months from the date of final acceptance of the building shall be amended and made good by the Contractor at his own cost. Architect shall furnish to the Contractor a letter indicating the date of final acceptance.

B. Where such defective work results in damage to the work installed under other sections of the Specifications, all such work shall be restored to its original condition at the expense of the Contractor by parties skilled in the particular work required.

1.8 DRAWINGS

A. These Specifications are accompanied by Drawings indicating typical layouts, pipe, conduit sizes, outlet and equipment locations, etc. Drawings and these Specifications are complementary each to the other and what is called for by one shall be as binding as if called for by both. All electrical outlets indicated on the Drawings are schematic. Exact location of each outlet shall be based upon exact architectural dimensions and related mechanical details.

B. Drawings as prepared are in general diagrammatic. Contractor shall carefully lay out his work at the site to conform to existing conditions, architectural, structural, mechanical, and electrical conditions, to avoid all obstructions and to conform to details of installation as indicated on the Drawings and supplied by the manufacturers of the equipment to be installed and thereby to provide an integrated, satisfactorily operating installation. All necessary offsets in piping, fittings, etc., required to avoid interferences between piping, equipment, architectural, and structural shall be furnished and installed by the Contractor without additional expense to the Owner or Architect.

C. Routing paths for all piping, power feeders, and branch circuits are not indicated on the Drawings. Routing paths which are indicated are schematic and are not accompanied by dimensional data or detailed for every required offset. Contractor shall have his choice of routing paths for such piping and raceways provided that this routing does not interfere with existing conditions and does not violate the requirements of the Owner. In cases where inference develops or in cases where proposed routing is not in accordance with the requirements of the Owner, a representative of the Owner will direct the required path of routing. All trenching, tunneling, piping, conductors, conduit, boxes, fittings and supports required to install piping and raceways indicated on the power riser diagram, and floor plans are herby included in the project requirements and shall be included in the proposal submitted by the Contractor.

D. These Specifications and Drawings accompanying same are intended to cover systems which will not interfere with new building conditions, which will fit into the available spaces, and which will ensure complete and satisfactory systems. Contractor shall, therefore, carefully examine the Drawings and the building and shall be responsible for the proper fitting of his material and apparatus into the building.

E. Contractor's attention is directed that all equipment he proposes to furnish must fit into the space allocated for same on the Drawings. It shall be the Contractor's responsibility to furnish data to evident that sufficient space can be provided for the installation of proposed equipment and that adequate access will exist for service and maintenance of equipment. Should changes become necessary during construction, the Contractor shall make such necessary changes at his (the Contractor's) own expense.

1.9 CHANGES

Any changes from the Drawings necessary to make the installation conform to building construction, to make this work fit the work of other trades, or to make this work conform to the rules of the city and municipal bodies having jurisdiction shall be made by the Contractor at his (the Contractor's) own expense.

1.10 PROTECTION

All work, equipment, and materials shall be protected at all times to prevent damage or breakage either in transit, storage, installation, or testing. All openings shall be closed with caps or plugs during installation. All material and equipment shall be covered and protected against dirt, water, chemicals, or mechanical injury. Failure on the part of the Contractor to provide adequate protection will be cause for rejection of the unprotected equipment and materials.

1.11 CUTTING AND PATCHING

A. Where existing surfaces are disturbed, cut, or damaged and these surfaces are exposed to view in finished areas, Contractor shall replace same with materials and finish matching existing surfaces. All patches, etc., shall thoroughly bond with the original surfaces and shall be level with same. Cutting and patching of existing surfaces shall be done by parties skilled in that particular work. All openings around conduits or piping through floors or walls shall be grouted and sealed.

B. Work shall be carefully laid out in advance and the exact size and locations of openings required shall be furnished to the General Contractor. Contractor shall be responsible for the furnishing and setting for the proper and permanent location of all sleeves, hangers, supports, inserts, plates, etc. If any cutting of the construction is necessary because of erroneous locations or to patch openings not used, the work shall be done at the expense of the Contractor by parties skilled in that particular work. No cutting or core drilling shall be done without permission of the Architect. All drilling and patching for expansion bolts, hangers, and other supports shall be done by the Contractor, subject to the approval of the Architect.

C. Contractor’s attention is directed that existing roofs are bonded roofs and warranty of work cannot be disrupted. Cutting and patching of roofs, mopping new equipment and pipe supports into existing roof, cutting new duct penetrations through roof, and flashing/sealing roof curbs into existing roof shall

be done in accordance with instructions, method, etc., of a roofing Contractor approved by the Owner.

1.12 EXCAVATION AND BACKFILL

Each Contractor shall provide all necessary excavation and backfilling required for his work. Excavation shall be backfilled with approved material tamped and puddled compactly in place to a density required to leave surface of ground at original level without settlement.

1.13 SLAB AND WALL PENETRATIONS

All piping and conduit passing through the floors or exterior walls shall have the space between the penetrated surface and the pipe or conduit packed and caulked watertight and rodent proof.

1.14 CERTIFICATION OF INSTALLATION BY EQUIPMENT MANUFACTURER'S REPRESENTATIVE

A. In order to place responsibility for the furnishing of the proper equipment and to see that it is installed as intended by the manufacturer, the Contractor, during construction, shall request supervisory assistance from the equipment manufacturer's representatives so that the material installation will be properly installed. After installation, the Contractor shall again request the representatives to inspect and certify that the equipment is in proper working order.

B. Before final payment is issued, the representatives shall submit to the Architect, through the Contractor, a signed statement certifying to their inspection and that the equipment is properly installed and ready for operation.

1.15 VIBRATION AND NOISE

Vibration and noise made in any part of the building by the operation of the Contractor's equipment will be objectionable and the Contractor shall take all precautions against same by isolating the various elements from the building and by such other means as may be necessary to eliminate all vibration and objectionable noise.

1.16 ESCUTCHEONS

Where exposed pipes pass through floors, walls, or ceilings, they shall be fitted with chromium plated stainless steel escutcheons firmly secured to the pipes and held in place with set screws.

1.17 FIRE PROTECTION/SOUND ATTENUATION SEALANT

A. All pipe, conduit, etc., penetrations through fire separation walls, partitions, floors, etc., shall be sealed with firestop sealant or foam system. Firestop sealant or foam shall be UL classified for the application, shall have intumescent characteristics, and shall be listed (1 hour, 2 hour, 4 hour) to match the rating of surface penetrated.

B. All pipe, conduit, etc., penetrations through walls, partitions, floors, etc., which are not fire rated but are intended to attenuate sound shall be sealed with expandable foam or other material to provide sound barrier.

1.18 CLEANING

Contractor shall thoroughly clean all equipment, materials, and devices furnished and set by him. Contractor shall remove all of his debris that may have accumulated during the job. After the Architect inspects the equipment, any discrepancies shall be amended as directed.

1.19 USE OF ENGINEERS ELECTRONIC DRAWINGS

The Contractor may request the use of electronic copies of the Engineers Drawings for preparation of Contractor shop drawings. All such requests must be presented to the prime design firm. Upon receipt by the Engineer of the executed Engineer's standard Waiver of Indemnification and upon receipt by the Engineer of compensation in the amount of two hundred fifty dollars ($250) to receive Drawings by mail and two hundred dollars ($200) to received Drawings electronically. The Engineer will forward requested Drawings (with Engineering seal removed) through the prime design firm for use by the Contractor.

1.20 OWNER TRAINING

A. Owner training is required by other sections of these Specifications. The Contractor must include evidence of completed Owner training with (bound within) the Operation and Maintenance manuals. Such evidence of completed Owner training shall include the following:
   1. Owner training log to include:
      a. Typewritten names with job titles and signatures for each person in attendance.
      b. The time, date, and duration of each training session.
      c. A comprehensive list of all training topics covered.
      d. A comprehensive list of all demonstrations and/or hands-on training for items such as systems programming, maintenance techniques, etc.
   2. Copy of audio and/or video recordings of training sessions where such recordings are required by other sections of these Specifications.

END OF SECTION

SECTION 21 13 00
WET SPRINKLER SYSTEMS RENOVATION AND DRY PIPING SYSTEM

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them.

1.2 SUMMARY

A. The existing building is presently served by a wet pipe sprinkler system. Contractor shall remove existing branch piping within the renovated spaces, and sprinkler heads as required for areas noted on Drawings. Contractor shall install new piping and new sprinkler heads as required to accommodate the revised spaces throughout the spaces noted on the Drawings (new partitions, usage, lighting layouts, duct layouts, etc.). Existing spaces that require no work can maintain the existing piping and head layout provided heads, spacing, etc., meet NFPA 13 requirements. All piping requiring repair shall be replaced.

B. Perform all work required to provide and install pipe, fittings, valves, hangers, supports, sleeves and appurtenances for reworking and/or expanding existing wet sprinkler systems with all supplementary items necessary for complete, code compliant and approved installation.

C. Contractor shall include within his bid all materials and work to provide 100% sprinkler protection for entire areas affected by the renovation work associated with this project.

D. Size all branches and mains by hydraulic calculations. Contractor shall obtain water supply information to determine actual available volume and pressures as a design basis. This Contractor shall verify that the affected existing systems are configured and functioning properly according to NFPA-13. Hazard classifications for fire protection system design, installation and water supplies shall be in accordance with NFPA Standards. Sprinkler head locations and spacing for light hazard occupancies shall be in accordance with NFPA 13 requirements.

E. Interface all new flow and valve supervisory switches with building fire and smoke alarm systems.

F. Provide temporary fire protection during the construction phase of project.

G. The city of Victoria Fire Marshall is the Local Authority Having Jurisdiction (AHJ) for fire protection system equipment, materials, installation and applicable Code interpretations.

1.3 REFERENCE STANDARDS

A. The latest published edition of a reference shall be applicable to this project unless identified by a specific edition date.

B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this project.

C. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:
   1. NFPA 13 - Installation of Sprinkler Systems.
   2. State of Texas, State Fire Marshal Rules.
   3. City of Victoria, Texas, Fire Department Standards.

1.4 QUALITY ASSURANCE

A. Sprinkler system design, testing, cleaning, certification, materials, equipment and installation shall meet the requirements of the latest editions of Referenced Standards.

B. Obtain and become familiar with requirements of Owner's insurance underwriter, and incorporate all applicable provisions for compliance.

C. Thoroughly and clearly document all project related communications with code and regulatory agents and expediently forward communication documentation to the project manager.

D. Equipment and components shall bear FM label or marking. Provide manufacturer’s name and pressure rating marked on valve body.

E. All hose threads, coupling types, etc., utilized in the fire protection systems shall conform to the standards and requirements of the City of Cuero, Texas Fire Department.

F. Maintain at least one copy of all system related documents on site.

G. Design sprinkler system under direct supervision of a R.M.E.’s (Responsible Managing Employee) experienced in design of this work and licensed in the State of Texas. All design submittal documents and shop drawings shall bear the R.M.E.’s signed and dated registration number. The system shall be installed by a firm having minimum three years experience regularly engaged in the design and installation of automatic fire protection systems in accordance with requirements of the National Fire Protection Association and the State of Texas Fire Marshal’s office. Evidence to support the above requirements shall be submitted with shop drawings. Working plans shall be sealed by an engineer registered by the Texas State Board for Professional Engineers in fire protection specialty.

1.5 SUBMITTALS

A. General:
1. All re-work applications employing twenty (20) or more sprinklers shall be submitted for approval as described herein. Product data shall be submitted for all size projects as described herein.
2. No work shall be performed until the shop drawings, calculations and product data have been approved by the Owner's insurance underwriter. The Contractor is solely liable for any work performed or material purchases made prior to this approval.

B. Product Data: Provide data on sprinkler heads, piping materials, joining methods, supports, valves, flow switches, tamper switches and all other components and accessories intended to be installed. Include manufacturers' catalog information, Code and Standards compliance, performance ratings, rough-in details, weights, finishes, support and connection requirements.

C. Record Documents:
1. Submit preliminary layout showing head locations within coordinated ceiling grid and inspector's test station locations for review by Architect / Engineer and Project Manager.
2. Where expanding existing systems, the submitted design Drawings shall show sufficient amount of the existing system as required to clearly identify how the new work connects to the existing system. Where re-working existing systems, show the existing system in detail on the Drawings.
3. Hydraulic calculations: Submit comprehensive hydraulic data sheets complying with NFPA 13. Verification of the adequacy of water pressure and other pertinent water supply data shall be the responsibility of the design engineer.
4. As-Built Drawings: Provide three sets of As-Built Record Drawings indicating actual installed locations, sizes and types of sprinkler heads, piping, valves, supports, equipment and all other system components. Identify all deviations from approved submittal drawings. Provide two sets of final hydraulic calculations and ACAD, version 14 or later, discs of As-Built Drawings.
5. Submit certification letter by engineer of record stating that the fire protection systems design complies with Referenced Standards.
6. Submit verification of Contractor's design and installation qualifications.
7. Provide full written description of manufacturer's warranty.
8. Provide certificate of compliance from authority having jurisdiction indicating approval of field acceptance tests. Refer to Paragraph 3.4 B, within this Specification Section.

D. Operation and Maintenance Data: Include components of system, servicing requirements, inspection data, replacement part numbers, location and numbers of service depot. Provide a preventive maintenance schedule for all applicable equipment and systems as required.

1.6 DELIVERY, STORAGE AND HANDLING

A. All materials shall be new, undamaged, and free of rust. Protect installed piping, valves and associated materials during progression of the construction period to avoid clogging with dirt, and debris and to prevent damage, rust, etc.

B. Accept valves on site in shipping containers and maintain in place until installation. Provide temporary protective coating and end plugs on valves not packaged within containers. Maintain in place until installation.

C. Protect all materials that are to be installed within this project from exposure to rain, freezing temperatures and direct sunlight.

1.7 EXTRA MATERIALS

The Contractor shall provide supply of spare heads of each type installed under the Contract in quantities as required by National Fire Protection Association Standard No. 13. The heads shall be packed in a suitable wall mounted sprinkler cabinet and shall be representative of and in proportion to, the number of each type and temperature rating installed. In addition to the spare heads, the Contractor shall provide not less than three special sprinkler head wrenches for each type of head. The cabinet shall be located where directed by the Owner.

PART 2 PRODUCTS

2.1 GENERAL

A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

B. All piping, materials and equipment used in the installation of sprinkler systems shall be compatible with the existing installation, new, and listed as approved by the Underwriters' Laboratories, Inc., List of Inspected Fire Protection Equipment and Materials and the Factory Mutual Testing Laboratories List of Approved Equipment, Fire Protection Devices and Devices Involving Fire Hazard and shall be the latest design of the manufacturer.

C. Pressure ratings of pipe, fittings, valves, gauges and all other water carrying appurtenances shall be suitable for the anticipated system pressures in which they are installed.

D. The installing Contractor shall identify piping, valves and hydraulic design information in accordance with applicable NFPA Standards.

2.2 FIRE PROTECTION SYSTEM-DRY STANDPIPE

A. Furnish and install a dry standpipe fire protection system for Building Stairwells complete, including, but not limited to, all pipe and fittings, fire hose valves, fire department siamese connection, and accessories.

B. All fire protection equipment and apparatus shall be approved by the National Board of Fire Underwriters by the Owner's insurance carrier and by the Victoria, Fire Department. All hose connections shall have threads conforming to the standards of the Victoria Fire Department. Piping shall be as herein before specified. The entire installation shall conform to the standards of NFPA Pamphlet No. 14 as published by National Fire Protection Association.

C. Valves located in stairs shall be Potter Roemer or equal Model 4065 with polished brass chrome plated 2-1/2" valve and No. 4625 polished brass and chains.

D. Fire department siamese connection shall be Potter Roemer or equal Model 5025, flush fire department inlet connection, 2-1/2" x 2-1/2" x 6", polish brass, polished brass plugs, chains and escutcheon with lettering on escutcheon reading "DRY STANDPIPE".

2.3 ACCEPTABLE MANUFACTURERS

A. Sprinkler Heads: Reliable, Grinnell, Viking.

B. Flow Switches: Notifier, Potter-Roemer.

C. Tamper Switches: Notifier, Potter-Roemer.

D. Gate Valves: Mueller, Nibco, Stockham, Kennedy.

E. Butterfly Valves: Milwaukee, Nibco, Victaulic, Kennedy.

F. Ball Valves: Milwaukee, Nibco, Stockham, Grinnell, Victaulic.

G. Check Valves: Mueller, Nibco, Stockham, Grinnell, Victaulic.

H. Grooved Fittings and Couplings: Grinnell, Anvil, Victaulic.

2.4 SPRINKLER HEADS

A. Unless otherwise specified or indicated on the Drawings, sprinkler heads shall be regular automatic closed type spray heads with temperature ratings as required by National Fire Protection Association Standard No. 13.
   1. Finished Ceilings: Provide concealed ceiling sprinklers with factory finished (no field painting) cover plate, color to match ceiling finish. [Exception: Provide chrome plated cover plates where directed by Architect].
   2. Unfinished Areas without Ceilings: Provide bronze upright. Protect sprinkler heads susceptible to mechanical injury with standard guards.

2.5 PIPING MATERIAL

A. Unburied pipe shall be schedule 40 black steel. Fittings shall be threaded malleable iron, welded black steel, grooved malleable or ductile iron with gaskets and mechanical fasteners.

B. Mechanical tee assemblies (saddles) shall only be used to connect new branch lines and hose valve supplies to existing standpipes. Hole cutting tools approved by the mechanical tee assembly manufacture shall be used for all tapping procedures.

2.6 VALVES

A. Similar types of valves shall be the product of one manufacturer; i.e., all butterfly valves shall be of the same manufacture, all ball valves shall be of the same manufacture, etc.

B. All valves used to control the flow of water to and within standpipe and sprinkler systems shall be listed indicating type complete with electric supervisory switches. Coordinate wiring with the electrical Contractor.

PART 3 EXECUTION

3.1 INSTALLATION

A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.

B. All installation shall be in accordance with manufacturer’s published recommendations.

C. Sprinkler heads shall be located in a symmetrical pattern related to ceiling features such as grid, beams, light fixtures, diffusers, etc. and where applicable, heads shall be located symmetrically with the ceiling grid, centered in two directions.

D. Locate sprinkler heads to provide code required distances away from lights, exit signs, ceiling clouds, shelving systems, partitions, etc., and all other items that could interfere or effect sprinkler discharge.

E. Apply temporary protective covers during construction to ensure that sprinkler heads and escutcheons do not receive field paint.

F. Inspector's test valves shall be installed for each flow switch and located accessibly from a standing position in areas non-accessible by the public or unauthorized personnel and as approved by Owner. Discharge water shall be piped to the building exterior or a drain capable of handling full flow without backup or splatter.

G. Provide hangers for horizontal piping at intervals not exceeding twelve feet for pipe sizes 1-1/4" and smaller or fifteen feet for pipe sizes 1-1/2" and larger, and as recommended within NFPA.

H. Route piping in orderly manner, plumb and parallel to building structure and concealed above ceilings where possible. Locate concealed valves, switches

and alarm connections in accessible location, and coordinate size and location of access panels/doors with General Contractor.

I. Install piping to conserve building space and not interfere with use of space and other work. Coordinate with other trades to avoid conflicts and provide all required offsets, piping, auxiliary drains, etc. to properly install system.

J. Group piping whenever practical at common elevations.

K. Install piping to allow for expansion and contraction without stressing pipe, joints or connected equipment.

L. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.

M. Provide drain valves at main shutoff valves, low points of piping and apparatus.

N. Provide an approved splash block at the point of drain or system test discharge outside of the building, where the ground may be disturbed by the flow of water.

O. Prepare pipe, fittings, supports and accessories for finish painting where required.

P. Install valves with stems upright, not inverted. All valves shall be located such that the removal of their bonnets is possible. Valves placed in horizontal lines shall be installed with their valve stems inclined at an angle of a minimum of 30 degrees above the horizontal position. Valves shall be installed as nearly as possible to the locations indicated in the construction drawings. Any change in valve location must be so indicated on the record drawings. Remove protective coatings after installation.

Q. All piping shall be clean when it is installed. Before installation it shall be checked, upended, swabbed, if necessary and all rust or dirt from storage or lying on the ground shall be removed. Flush entire system of foreign matter.

R. All screw joints shall be made with taper threads, properly cut. Joints shall be made tight with Teflon tape or non-toxic joint compound applied to the pipe threads only and not to fittings. When threads are cut on pipes, the ends shall be carefully reamed to remove any burrs. Before installing pipe that has been cut and threaded, the lengths of pipe shall be upended and hammered to remove all shavings and foreign material.

3.2 TESTING AND FLUSHING

A. Testing, cleaning, flushing and inspection shall be done in accordance with NFPA requirements.

B. The installing Contractor shall complete and sign the appropriate Contractor's Material and Test Certificates included within NFPA 13 and 14. Tests and signing of test certificates shall be witnessed by Fire Marshal, Owner, or designee.

C. Hydrostatically test entire system and test shall be witnessed by Fire Marshall.

END OF SECTION

SECTION 22 00 05
PLUMBING SPECIFICATIONS

PART 1 GENERAL

1.1 GENERAL

A. The "Mechanical and Electrical Specifications (Common Conditions)", is a part of these Plumbing Specifications for Parish Hall Package B – Our Lady of Victory Catholic Church – Diocese of Victoria, Victoria, Texas.

B. Sections of the Specifications covering general conditions and supplements are a part of the contract. Contractor shall observe all requirements thereof, insofar as they pertain to his work.

1.2 CODES AND STANDARDS

All workmanship, material and equipment shall be in accordance with all applicable local, state and federal codes, ordinances and regulations.

1.3 CONTRACTOR'S RESPONSIBILITY

A. Carefully examine all of the Contract Documents and comply with them in every respect. Should there be omissions or discrepancies in the documents notify the Owner’s Representative prior to the bid date so a written clarification can be issued.

B. Coordinate exact electrical requirements of all mechanical equipment prior to submittal review and make all modifications necessary for full compatibility with the final electrical installation.

C. Carefully examine conditions of the project site and to check the work of other divisions that might affect the plumbing work.
   1. Visit the proposed project site prior to bid and carefully investigate existing streets, parking lots, paved areas, sidewalks, buildings and structures.

D. Coordinate with general construction the location of chases, openings, sleeves, flashings, trenches, and the like required for the work covered by the Plumbing Division of the Contract Documents. No cutting of structural members shall be performed without approval of the Owner’s Representative.

1.4 ADDITIONAL COMPENSATION

A. Failure to examine or to comply with Contract Documents shall not relieve Contractor of responsibility for the work or be used as basis for additional compensation.

B. No additional compensation will be awarded for conflict with Architectural, Structural, Electrical, or Mechanical components in installation of prefabricated materials or equipment. Piping shall be fabricated from field measurements.

Contractor shall advise Owner's Representative of any discrepancies prior to fabrication.

1.5 SUPERVISION, LABOR AND WORKMANSHIP

Contractor shall provide proper supervision of mechanics and subcontractors performing work under this division. Labor shall be performed by skilled mechanics experienced in their particular trade. Piping and equipment shall be installed square and plumb, with accessibility for proper operation and service. Any item that does not present a neat and workmanlike appearance shall be replaced or corrected at the direction of the Owner's Representative and without additional cost to the Owner or Design Professionals.

1.6 FEES AND PERMITS

Contractor shall obtain and pay for all fees and permits required for the completion of the work, including but not limited to construction permits; federal, state and local inspection fees; connections to utilities; meter and tap fees (if required); capitalization charges; temporary service charges; and any other associated fees or charges.

1.7 PROJECT/SITE CONDITIONS

A. Install Work in locations shown on Drawings, unless prevented by Project conditions.

B. These Specifications and the accompanying Drawings are intended to describe and illustrate systems which will not interfere with the structures, which will fit into available spaces, and which will insure complete and satisfactorily operating installations. Coordinate the proper fitting of the material and apparatus into the available spaces without interfering with other building components. Prepare installation drawings at all locations where possible conflicts of HVAC, electrical, structural or architectural components may occur.

1.8 SUBMITTALS

A. Submit in timely manner for review, brochures describing all materials, equipment and fixtures proposed for use in the performance of the work on this project.

B. Information shall be presented so that line-by-line comparison may be made with Contract Documents. Deviation from Contract Documents shall be enumerated on separate sheet and so entitled. Data of general nature will not be acceptable.

C. Each brochure shall be neatly organized (i.e. separate tabs for each system with a corresponding Table of Contents) into a single binder or electronic PDF file to include all proposed equipment in a single submission. In each brochure or electronic file, provide cover sheet identifying project name and location, Architect, Engineer, General Contractor, and Mechanical Contractor. Include Contractor's addresses and phone numbers. Provide adequate space for Architect's and Engineer's stamps. Contractor shall include and sign the following statement of compliance on the cover sheet:

I hereby certify that this shop drawing and/or brochure has been checked prior to submittal and that it complies in all respects with the requirements of the Contract Documents for this project.

(Company Name)
Signed
Date

Submittals not complying with all the provisions of this Section will be rejected in hand.

D. Engineer's review of submittals does not relieve Contractor of his responsibility for deviations from Contract Documents or errors and omissions except when acceptance of the specific deviation is given in writing.

E. Coordinate exact electrical requirements of Plumbing equipment and fixtures with electrical division prior to submittal of brochures.

1.9 TEMPORARY CONNECTIONS

Plumbing Contractor shall provide temporary water connections required for construction purposes.

1.10 CONNECTIONS AND SERVICES TO EQUIPMENT SPECIFIED ELSEWHERE

A. Prior to rough-in for fixtures and equipment, Plumbing Contractor shall obtain certified rough-in prints of fixtures and equipment. Plumbing Contractor shall verify that these prints have been checked by the Architect and have been approved by the Architect. No rough-in shall be done by Plumbing Contractor until certified prints are obtained.

B. Plumbing Contractor shall furnish and install the following for the fixtures (fixtures noted with an asterisks * shall be by the owner and connected by the plumbing contractor) and equipment: water and waste piping, install shut-off valves on water piping at each piece of equipment requiring water, furnish and install all pipe fittings required, furnish and install traps, and make final connections.

1.11 RELATED WORK SPECIFIED ELSEWHERE

A. The following related work is specified elsewhere:
1. Installation of flashing and waterproofing.
2. Furnish and install all electrical wiring required for electric water heaters and electric water coolers.
3. Installation of access panels if any access panels are required.

1.12 DISPOSAL OF EXCAVATED MATERIALS

Excavated materials, so far as needed and of a suitable and acceptable character, shall be piled adjacent to the excavations to be used as backfill as required. All excavated material that is unsuitable for backfilling purposes, or which is in excess of the amount

required or needed to satisfactorily complete the backfill, shall be piled at a location on the site designated by the Owner.

1.13 ROOF FLASHING

Plumbing Contractor shall furnish flashing and counterflashing required, including flashing for roof drains. Roofing Contractor shall install flashing and waterproofing. Plumbing Contractor shall install counterflashing where counterflashing is required.

1.14 SUPPORTS

A. Plumbing Contractor shall furnish and install all necessary steel braces, supports, hangers, etc., for properly supporting piping, fixtures, etc.

B. Provide any foundations and supports indicated on the Drawings, and not specifically noted as being provided by the General Contractor, specified elsewhere herein or required by condition at the site.

1.15 DOMESTIC WATER SERVICE

Domestic water piping shall connect to existing domestic water piping at locations indicated on the Drawings.

1.16 SANITARY SEWER SERVICE

Sanitary sewer piping shall connect to sanitary sewer piping outside lines of buildings at locations indicated on the Civil Drawings.

1.17 SOIL, WASTE, GREASE WASTE, VENT PIPING AND ROOF DRAIN PIPING

A. Furnish and install soil, waste, grease waste, vent and roof drain piping as indicated on the Drawings and as follows:
   1. Soil and Waste Piping: Soil and waste piping shall be Schedule 40 PVC drainage pipe with socket type drainage fittings for solvent cemented joints.
   2. Vent Piping: Vent piping shall be Schedule 40 PVC drainage pipe with socket type drainage fittings for solvent cemented joints.
   3. Installation:
      a. Horizontal soil and waste and drain piping within the building shall be given a grade of no less than 1/8 inch per foot except where otherwise indicated on the Drawings. All offsets shall be made at an angle of not more than 45 degrees.
      b. All changes in pipe sizes shall be made with reducing fittings or recessed reducers. Wye fittings and 1/8 or 1/16 bends or combinations wye and 1/8 bends shall be used where possible.
   4. Roof Drain and Overflow Roof Drain Piping: Roof drain piping, other than roof drain piping located within HVAC return air plenums above ceilings, shall be Schedule 40 PVC drainage pipe with socket type drainage fittings for socket cemented joints.

5. Installation and piping installed within return air plenum:
6. Horizontal soil and waste and drain piping within the building shall be given a grade of no less than 1/8 inch per foot except where otherwise indicated on the Drawings. All offsets shall be made at an angle of not more than 45 degrees.
7. All changes in pipe sizes shall be made with reducing fittings or recessed reducers. Wye fittings and 1/8 or 1/16 bends or combinations wye and 1/8 bends shall be used where possible.
8. Soil, waste, vent and roof drain piping located within HVAC return air plenums shall be hubless cast iron pipe and fittings and hubless soil pipe couplings, CPVC (must meet 25/50 flame smoke spread requirements) piping with socket type drainage fittings for socket cemented joints or if allowed by the AHJ, PVC piping insulated with 25/50 flame smoke spread wrap.

1.18 GREASE TRAPS (INTERCEPTORS)

A. A grease interceptor system shall be provided and installed as indicated on plans. Refer to Plumbing Fixture Schedule for specification of grease interceptors. The system shall be installed in strict accordance with the manufacturer's recommendations local code requirements.

B. Grease interceptor system shall be provided with a set of installation, operation, and maintenance manuals that contain clear and concise descriptions.

C. Grease interceptor system design shall conform to criteria set forth by the International Association of Plumbing and Mechanical Officials (IAPMO), to ASME grease interceptor standard #A112.14.3 and CSA B481.1, and all other governing state and local code requirements.

D. Contractor shall submitted required copies of manufacturer's equipment specification for engineer's review. Shop drawings shall include the following:
   1. Detailed manufacturer's data including installation plan / elevation drawings.
   2. Manhole frame / cover specifications.
   3. Pipe and Tank Specifications.
   4. Flow Control Specifications.
   5. Anchor Kit.
   6. System shall be filled with clean water prior to start-up of system. Follow manufacturer’s recommendations for testing and start-up.

1.19 DOMESTIC WATER PIPING

Furnish and install water piping as indicated on the Drawings and as follows: Water Piping Above Grade: Piping shall be copper tubing, ASTM B88, Type L, K, hard drawn piping, cast copper alloy or wrought copper and bronze or Pro Press fittings by Viega. Copper press fittings shall have a specific design feature to guarantee that un-pressed fittings will not hold at any pressure between 15 and 85 PSIG. Press fittings from various manufacturers shall not be mixed. Solder joints, ASTM B32, Grade 95TA. Solder shall be lead free and antimony free and shall conform to the Safe Water

Drinking Act Amendments, enforceable since June 1988. Solder shall be Silverbrite 100 as manufactured by Englehard Corporation or approved equal.

1.20 TEST OF SOIL, WASTE, GREASE WASTE, VENT AND ROOF DRAIN PIPING SYSTEMS

Soil, waste, grease waste, vent and roof drain piping systems shall be given a water test. Piping shall have openings plugged where necessary and be filled with water to the level of top of vent pipe and allowed to stand for not less than 12 hours for inspection, after which, if the lines prove tight, the water shall be drawn off and the fixtures connected.

1.21 TEST OF DOMESTIC WATER

Domestic water piping shall be tested under 125 psi hydrostatic pressure for a period of 12 hours. Any leaks made evident shall be repaired and the test repeated to completion.

1.22 CROSS CONNECTIONS AND INTERCONNECTIONS

No plumbing fixtures, devices, or piping shall be installed which will provide a cross connection or interconnection between a distribution supply for drinking or domestic purposes and a polluted supply such as a waste pipe which will permit to make possible the backflow of sewage, polluted water, or waste into the water supply system.

1.23 STERILIZING OF WATER PIPING

After the installation of all water piping is made, it shall be thoroughly sterilized with a water solution containing not less than 50 P.P.M. of available chlorine, in accordance with the regulations of the State Health Department. Sterilizing agent shall be thoroughly mixed with the water; solution shall remain in pipes not less than six hours and the lines shall then be flushed out.

1.24 PIPING FABRICATION AND INSTALLATION

All piping shall be installed in accordance with the following provisions:

A. All piping shall be accurately cut to measurement established at the job by the contractor, and shall be worked into place without springing or forcing. Proper provisions shall be made for expansion and contraction of all pipe lines.

B. All piping shall be properly supported to prevent undue strain or sagging. All piping above the ground shall be supported by hangers. Hanger spacing shall not exceed the following maximum distances between supports.

1.	1" and smaller	7'-0"
2.	1 1/4"	8'-0"
3.	1 1/2" – 3”	10'-0"
4.	PVC pipe	4'-0"

C. Before being placed in position, all pipe, fittings, and equipment shall be cleaned carefully. All materials and equipment shall be maintained in a clean condition,

and upon completion of final tests and acceptance shall be left in a clean condition.

D. Unions shall be installed in piping where indicated on the Drawings and where necessary for easy dismantling of the piping and apparatus.

E. Pipe fittings shall be free of fins and burrs and pipe shall be reamed after cutting. Threads on screwed pipe shall be run full cut and not more than three threads shall remain exposed after the joint is made up tight. Screwed joints shall be made with joint compound applied to the male threads only.

F. No bushings will be allowed in any piping. Copper or brass adapters shall be used for joining copper pipe to screwed valves or fittings.

G. Copper piping above grade shall be soldered with lead free solder, Harris Co. Bridget or Canfield 100% Watersafe.

H. Steel nipples will not be permitted in copper piping.

I. Furnish and install compression type stops on supply piping to all fixtures including equipment and fixtures specified elsewhere.

J. Air chambers the same diameter as the supply pipe and 18" long shall be provided on branches to fixtures. All air chambers shall be concealed in chases or partitions.

K. Any connection between a copper pipe and a steel pipe or steel tank shall be made with an approved dielectric fitting.

L. All piping shall be made up straight and true at proper grades.

M. Where piping is to be installed in chases or in a wall, it shall be installed and inspected prior to enclosing.

N. All piping passing through roof shall be flashed with 4 lbs. lead. Base of flashing shall be not less than 8" in all directions from outside of pipe and not less than 6” in all directions from outside of roof drain seepage pans.

O. Trench safety system shall comply with the appropriate requirements established in the Occupational Safety and Health Administration (OSHA) Safety Health Requirements, Part 1926, Subpart P, Excavation, Trenching, and Shoring.

1.25 WATER VALVES

A. Valves shall be furnished and installed where indicated on the Drawings and where necessary for proper functions of the piping systems. Valves shall conform to the following schedule or equal:

1. Ball valves, 1 1/2" or smaller - Nibco or equal, Class 150, bronze, one piece body, chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, solder or threaded ends with union.

2. Gate valves, 1 1/2" or smaller - Nibco No. T-113 or S-113 or equal.
3. Valves for underground PVC piping shall be Kenedy Valve Mfg. Co. or equal Fig. 597X A.W.W.A. gate valve with PVC connections; iron body, bronze mounted; double discs; parallel seats; wedge pin disc spreader mechanism; 200 lb. cold water working pressure; handwheel.

1.26 UNIONS

Unions for water piping shall be Nibco No. 633 copper or Crane 125 lb. rough brass or equal.

1.27 HOSE BIBBS

Refer to Plumbing Fixture Schedule on Drawings for specification of hose bibbs.

1.28 PIPE HANGERS

A. All piping above the ground shall be supported by pipe hangers and clamps. Vertical risers shall be supported by Grinnell or equal Fig. 261 galvanized carbon steel clamps. Horizontal lines shall be supported by Grinnell or equal Fig. 268 galvanized carbon steel adjustable clevis hangers, attached to the structural members or masonry by means of inserts, clamps, or bolted angle clips. Perforated strap hangers will not be permitted in any part of the work. Copper clad hangers shall be used to support uninsulated copper piping.

B. Pipe hangers for medical oxygen and air piping shall be felt lined.

C. Twenty (20) gauge galvanized steel half shields extending 4" on each side of the hanger or clamp shall be provided at each location where a hanger or clamp is installed to support an insulated pipe. Shields shall be installed over the insulation.

D. Hanger rods shall be galvanized carbon steel rods or bolts threaded with provisions for vertical adjustment and provided with nut or locknut.

1.29 CLEANOUTS

A. Cleanouts shall be provided in such locations that each and every line throughout the job may be rodded and shall be so located that they will be readily accessible for rodding out soil and waste lines. Contractor shall install cleanouts of the following types at locations indicated on the Drawings. Cleanouts shall be manufactured by Josam or equal. Cleanouts installed in floors having carpeting shall be furnished with carpet cleanout marker.

B. Refer to plumbing fixture schedule on Drawings for specifications of cleanouts.

1.30 ACCESS PANELS

A. All valves, vents, cleanouts, etc., must be accessible. Where these occur above ceilings other than lay-in type ceilings and at all other locations wherever

required to service his installation, contractor shall install access panels of size to allow adequate clearance and access for servicing.

B. Access panels shall be Karp Associates, Inc., or equal. Access panels shall be stainless steel No. 4 satin polish finish, flush mounted. Access panels shall be furnished with concealed continuous piano hinges and flush screwdriver operated lock with stainless steel cam and studs. Panels shall be suitable for use for the type of surface (wall, ceiling, etc.) in which installed.

C. Access panels shall be furnished to the General Contractor for installation.

1.31 FIRE PROTECTION SEALANT

All pipe penetrations through fire rated, walls, partitions, etc., shall be sealed with fire stop sealant or fire stop foam system. Fire stop sealant or foam shall be U.L. classified for the application, shall have intumescent characteristics, and shall be approved for usage by the City of Victoria, Texas.

1.32 INSULATION

A. Piping shall be insulated as specified herein. In each case the insulation shall be the material applied and finished as described in the specification.

B. It shall be the responsibility of the contractor to insure that an effective insulation and vapor seal is achieved on all cold surfaces which will eliminate any sweating or condensation on any cold surfaces installed by the contractor.

C. At each pipe support point on insulated piping, with the exception of hot water piping, install inserts of urethane pipe insulation. At each pipe support point on hot water piping install inserts of calcium silicate pipe insulation. Inserts shall be minimum 8" length, same thickness as adjacent insulation. Seal and finish to match the adjoining insulation.

D. Insulation and accessory materials shall meet NPFA non-combustible rating of maximum flame spread 25 and smoke developed 50 tested by ASTM E 84, NFPA 255, U.L. 723. Piping insulation shall meet the above requirements based on composite rating for insulation, jacket, and adhesive as a complete system.

E. Hot water piping shall be insulated with 1" jacket glass fiber pipe insulation with factory applied white jacket, Schuller or equal Flame Safe AP. Insulate fittings, valves, etc., with preformed insulation with PVC premolded one piece fitting covers, Schuller Uni-fit covers or equal. Adhere longitudinal and butt strips of jacket with factory applied pressure sensitive tape system.

F. Cold water piping shall be insulated with 1/2" thick glass fiber pipe insulation with factory applied white vapor barrier jacket, Schuller or equal Flame-Safe AP. Insulate fittings and valves with preformed insulation and jacket and finish with vapor barrier coating reinforced with glass fabric. Adhere longitudinal and butt strips of jacket with factory applied pressure sensitive tape system.

1.33 PAINTING

A. Equipment that is shipped with a factory finish shall be touched up to repair any damage to the finish.

B. All hangers, supports, etc., shall be primed with PPG Inhibitor Red Primer 6-208. In addition to primer, exposed hangers, supports, etc., shall be painted with two (2) coats of PPG Enamel 54 Line.

1.34 WATER HEATERS

A. Furnish and install water heaters where indicated on the Drawings. Water heaters shall be as Scheduled or equal.

B. Refer to plumbing fixture schedule on Drawings for specifications of water heaters.

1.35 PLUMBING FIXTURES

A. Furnish and install all fixtures as indicated on the Drawings and specified on plumbing fixture schedule, and including all brass in connection therewith, such as traps, supply tubing, stops, etc. All exposed trim shall be chrome plated on brass. All fixtures shall be provided with compression type stops on supply piping.

B. All plumbing fixture brass trim shall be NSF-61/Section 9 certified and shall be so designed that the supply fixture and faucets have all wearing parts in a standardized renewable operating unit, which can be removable without detaching the supply fixture or faucet proper. Actuating force required to operate handicapped accessible faucets must be less than 5 lbs.

C. Fixture mounting heights have been indicated for handicapped accessible fixtures in the following schedule of fixtures as a guide. Regardless of fixture mounting heights indicated, contractor must install fixtures at height meeting TITLE III PROVISIONS OF THE AMERICANS WITH DISABILITIES ACT.

D. Installation of plumbing fixtures and trim such as location of flush valves, faucets, etc., shall comply with Texas Accessibility Standard (TAS) of the Architectural Barriers Act.

1.36 INSTRUCTIONS

Contractor shall provide for instructing an employee or employees of the Owner in the operation and maintenance of the systems. Duplicate sets of manufacturer's certified drawings, specifications, operating instructions, maintenance manuals, and maintenance instructions on all equipment furnished by the contractor shall be furnished to the Owner.

END OF SECTION

SECTION 23 05 00
MECHANICAL GENERAL CONDITIONS

PART 1 GENERAL

1.1 SCOPE

A. The Work to be provided under this Division of Specification shall include the furnishing, delivering, transporting, unloading, hoisting, handling, scaffolding, storing, erecting, adjusting, and testing of all materials, apparatus, and equipment required for complete, properly adjusted and operable mechanical systems for the Our Lady of Victory Catholic Church – Diocese of Victoria Parish Hall project in accordance with the Contract Documents. Provide all labor, supervision, coordination, equipment, tools, materials, permits, fees, and connection to utilities necessary for the completion of this Work.

B. If details or special conditions are required in addition to those shown on Drawings, provide all material and equipment usually furnished with such systems or required to complete their installation, whether noted in Contract Documents or not.

C. The Instructions to Bidders, Notice to Bidders, General Conditions, Special Conditions, all other preface sections, all technical divisions and all appendixes of the Specifications, and any other pertinent documents issued by Owner's representative shall be considered as part of this Division insofar as they may be applicable.

D. The Architectural, Civil, Structural, Plumbing, Fire Protection, Heating, Ventilating and Air Conditioning (HVAC) and Electrical Plans and Specifications and any other pertinent documents issued by Owner's representative shall be considered as part of this Division insofar as they may be applicable.

E. Refer to Division 1 Specifications for general requirements of the following items:
   1. Work by Owner.
   2. Work sequencing and phasing.
   3. Bid Alternates.

F. Related Specifications:
   1. Refer to the following Specifications for coordination and HVAC Contractor requirements:
      a. Specification 01 23 00 Alternates.
      b. Specification 23 05 93 Testing, Adjusting and Balancing.
      c. Specification 23 09 93 Sequence of Operation.

1.2 CODES AND STANDARDS

A. The Codes and Standards of the following organizations shall generally apply where applicable and where no specific Codes and Standards have been

cited. In the event of conflict between the Codes and Standards of these organizations, the more stringent shall govern.

AABC:	Associated Air Balance Council.
ABMA:	American Boiler Manufacturer's Association.
ADC:	Air Diffuser Council.
AGA:	American Gas Association.
AMCA:	Air Moving and Conditioning Association.
ANSI:	American National Standards Institute.
API:	American Petroleum Institute.
ARI:	American Refrigeration Institute.
ASA:	American Standard Association.
ASHRAE:	American Society of Heating Refrigeration and Air Conditioning Engineers.
ASME:	American Society of Mechanical Engineers.
ASPE:	American Society of Plumbing Engineers.
ASTM:	American Society for Testing and Materials.
AWS:	American Welding Society.
AWWA:	American Water Works Association.
CGA:	Compressed Gas Association.
CTI:	Cooling Tower Institute.
FM:	Factory Mutual Engineering Company.
IRI:	Industrial Risk Insurers.
ISA:	Instrument Society of America.
MSS:	Manufacturers Standardization Society.
NBS:	National Bureau of Standards.
NEC:	National Electric Code.
NEMA:	National Electrical Manufacturer's Association.
NFPA:	National Fire Protection Association.
OSHA:	Occupation Safety and Health Administration.
PDI:	Plumbing and Drainage Institute.
PFI:	Pipe Fabrication Institute.
SMACNA:	Sheet Metal and Air Conditioning Contractors National Association.
UL:	Underwriters Laboratories, Inc.

B. All workmanship, material, and equipment shall be in accordance with all local, state, and federal codes, ordinances and regulations.

1.3 DEFINITIONS

A. “Contract Documents" shall refer to the complete package of Plans, Specifications, addenda, and special conditions used as a basis for the General Construction Contract for this project including but not limited to all General and Special Conditions, all Architectural and Engineering Divisions of Specifications and all Architectural and Engineering Plans.

B. “Owner” means the entity specified in the General Construction Contract as Owner.

C. "Contractor" means the entity contracting with the Owner for the performance of work.

D. “Work” means all of the Contractor’s obligations under the Contract.

E. “Provide” shall mean furnished and installed, complete and ready for intended use by Contractor, except as otherwise noted.

F. “Furnish” shall mean purchase only by Contractor; installation by others, except as otherwise noted.

G. “Install” shall mean Contractor to set up for use, erect or construct only; purchase by others, except as otherwise noted.

H. “Demolish” and “Remove” shall mean Contractor to disassemble, take away from site, and properly dispose of items as indicated or implied. Contractor shall patch remaining systems to match existing.

I. "Directed" means "directed by Owner’s representative”. This shall not imply that Architect's or Engineer's responsibility extends into the Contractor's area of construction supervision.

J. Where the words "similar" or "typical" are used, they shall be used in their general sense and shall not be interpreted as meaning identical. Details shall be worked out in relation to their location and connections to other parts of work.

K. Items such as but not limited to access doors, sleeves, cleanouts, trap-primers, roof flashings, pipe supports, or balancing dampers that are to be installed repetitiously and are noted on the Plans as "typical" shall be installed at every location required by Specifications, codes, or good practice, whether specifically shown on Plans or not.

L. Where the terms "or equal" and "or approved equal" are used they shall be defined as "approved as equal by Owner’s representative".

1.4 CONTRACTOR'S RESPONSIBILITY

A. It shall be the responsibility of the Contractor to carefully examine all of the Contract Documents and to comply with them in every respect. Should there be omissions or discrepancies in the documents notify the Owner’s representative prior to the bid date so a written clarification can be issued.
   1. Coordinate exact electrical requirements of all mechanical equipment prior to submittal review and make all modifications necessary for full compatibility with the final electrical installation.

B. It shall be responsibility of the Contractor to review all Divisions of the Contract Documents with respect to mechanical work that will be required by other divisions. Contractor shall thoroughly review all aspects of Mechanical Bid

Proposal prior to bidding for the purpose of clearly defining the scope of Mechanical Bid Proposal with that of all other trades.

C. It shall be the responsibility of the Contractor to provide all equipment, materials, and labor, whether specifically indicated on Plans or called for in Specifications or not, which are necessary for the proper installation and function of the mechanical systems for this project.

D. It shall be the responsibility of the Contractor to carefully examine conditions of the project site and to check the work of other divisions that might affect the mechanical work. Include all costs of demolition, cutting, patching, and repairing of existing elements in bid proposal.
   1. Visit the proposed project site prior to bid and carefully investigate existing streets, parking lots, paved areas, sidewalks, buildings, structures, and landscaping.

E. It shall be the responsibility of the Contractor to contact the Owner's representative prior to commencement of any trenching or site utility work for assistance in locating underground utilities. Hand dig where necessary to verify depth and location and to avoid damage to existing.

F. It shall be the responsibility of the Contractor to coordinate work performed under the Mechanical Division of the Contract Documents with work performed under other divisions so as not to delay or damage any part of this installation.

G. It shall be the responsibility of the Contractor to coordinate the location of chases, openings, sleeves, flashings, trenches, and the like required for the work covered by the Mechanical Division of the Contract Documents. Do so in sufficient time for proper coordination with general construction, or assume the responsibility for required cutting and patching. No cutting of structural members shall be performed without approval of the Owner's representative.

H. It shall be the responsibility of the Mechanical Division to include minor details necessary for proper installation and operation of materials, equipment, or fixtures as if specified or shown in Contract Documents.

I. It shall be the responsibility of the Contractor to install materials, equipment, and fixtures according to code requirements, manufacturer's recommendations or as required in Contract Documents, whichever is more stringent.

1.5 ADDITIONAL COMPENSATION

A. Failure to examine or to comply with Contract Documents shall not relieve Contractor of responsibility for the work or be used as basis for additional compensation.

B. No additional compensation will be awarded for conflict with Architectural, Structural, Electrical, or Mechanical components in installation of prefabricated materials or equipment.

1. Ductwork and piping shall be fabricated from field measurements. Adjust duct sizes as necessary to fit space available. Contractor shall advise Owner's representative of any discrepancies prior to fabrication.

C. No compensation will be awarded to the Contractor for minor relocations or deviations from plans. Changes in contract price will be allowed only for additions to or changes to original design intent and then only with written approval of the Owner's representative.

D. Omission of Architectural, Civil, Structural, Electrical, or other pertinent details from Mechanical Contract Documents shall not be used as basis for additional compensation.

E. No compensation will be awarded to the Contractor for failure to coordinate exact electrical requirements with electrical division prior to ordering equipment.

1.6 SUPERVISION, LABOR, AND WORKMANSHIP

A. Contractor shall provide proper supervision of mechanics and subcontractors performing work under this Division. Labor shall be performed by skilled mechanics experienced in their particular trade. Piping and equipment shall be installed square and plumb, with accessibility for proper operation and service. Any item that does not present a neat and workmanlike appearance shall be replaced or corrected at the direction of the Owner's representative and without additional cost to the Owner or Design Professionals.

B. Submit welder's certificates and resume of experience for all mechanics on this project when directed to do so by Owner's representative.

1.7 FEES AND PERMITS

Contractor shall obtain and pay for all fees and permits required for the completion of the Work, including but not limited to construction permits; federal, state, and local inspection fees, connections to utilities, meter and tap fees, capitalization charges, temporary service charges, and any other associated fees or charges.

1.8 PROJECT/SITE CONDITIONS

A. Install Work in locations shown on Drawings, unless prevented by Project conditions.

B. These Specifications and the accompanying Drawings are intended to describe and illustrate systems which will not interfere with the structures, which will fit into available spaces, and which will ensure complete and satisfactorily operating installations. Coordinate the proper fitting of the material and apparatus into the available spaces without interfering with other building components. Prepare installation drawings at all locations where possible conflicts of HVAC, Plumbing, Fire Protection, Electrical, Structural, or Architectural components may occur. The installation drawings shall be

submitted to the Owner's representative prior to commencing the Work. They should illustrate the installation of work in relation to other portions of the Work. Interferences with other portions of work, or the building structure, shall be corrected before the work proceeds. Should changes become necessary on account of failure to comply with these stipulations, make such necessary changes.

1.9 PRE-INSTALLATION CONFERENCE

A. Contractor shall convene a pre-installation conference one (1) week prior to commencing work of this Division and in conjunction with work of other divisions and notify Owner's representative of date and time of meeting. Comply with Section 01 70 00.

B. Require attendance of parties directly affecting work of Divisions 22, 23, and 26.

C. Review installation procedures and coordination required with related work.

D. Establish "right of way" and routes for conduit, wiring, cable trays, piping, ductwork, and similar elements in the available space above ceilings and vertical chases.

E. Coordinate exact plumbing, fire protection, electrical, and service access requirements of all HVAC equipment and fixtures. Coordinate exact HVAC and service access requirements of all plumbing, fire protection, and electrical equipment, as example, ventilation and exhaust of panelboards, transformers, generators, pumps, water heaters, or boilers. Advise Owner's representative of any requirements that will be necessary in addition to requirements on Contract Documents.

1.10 GENERAL REQUIREMENTS

A. Protection of Rough Work: All openings of every description shall be securely capped or otherwise protected against debris or other foreign material entering the system until such time as the equipment is permanently attached.

B. Cleaning and Adjusting: At the completion of the work all parts of the installation shall be thoroughly cleaned. All valves and controls shall be adjusted for proper operation. Upon completion of the work, the Contractor shall leave the building and project site in a neat condition.

C. Defective work: If inspection or testing show defects, such defective work or materials shall be replaced and inspection and test repeated. All repairs to piping shall be made with new material. No caulking of screwed joints will be acceptable.

D. Dielectric Connection: Where dissimilar metals are connected, provide approved dielectric connector to protect against dielectric corrosion.

E. Vents through Roof: Vents through roof shall be installed as closely as possible to locations shown on Drawings. However, in no case shall vents through roof be installed within ten feet of air conditioning outside air intakes. It shall be the responsibility of the Contractor to coordinate with the Plumbing and HVAC Divisions and offset vent piping as necessary. Offsets will be made at no additional cost to the Owner or Design Professionals.

F. Surveys and Measurements: Carefully survey project site prior to bidding and installation. Dimensions, both horizontal and vertical, shall be derived from Architectural, Civil, and Structural plans. Do not "scale" plans; that is do not measure plans with Architect's or Engineer's scale and base installation dimensions on such measurements.

G. Horizontal and vertical measurements shall be based on established benchmarks. Work shall agree with established lines and levels. Field verify measurements at project site. Check correctness of same as related to work prior to fabrication of shop made items and ordering of factory built items.

H. Notify Owner’s representative of discrepancies between plans and actual field conditions that will prevent the following of good practice or affect the intent of plans and Specifications. Do not proceed with installation until instructions are received from Owner’s representative.

I. The accompanying plans show diagrammatically the sizes and location of the various equipment items and the sizes of the major interconnecting piping and ductwork, without showing exact details as to elevations, offsets, control lines, and other installation details. The Contractor shall carefully lay out his work to conform to the site conditions, to avoid obstructions and provide proper grading of lines. Exact locations of outlets, apparatus, and connections thereto shall be determined by reference to the accompanying Plans, to all detail drawings, equipment drawings, rough-in drawings, etc., by measurements at the building, and in cooperation with other divisions, and in all cases shall be subject to the approval of the Owner’s representative. Minor relocations necessitated by the conditions at the site or directed by the Owner’s representative shall be made without any additional cost to the Owner.

J. All work shall be run parallel or perpendicular to the lines of the building unless otherwise noted on the Drawings.

K. It is the intent of the Contract Documents to provide an installation complete in every respect. In the event that additional details or special construction may be required for work indicated or specified in this Section or work specified in other Sections, it shall be the responsibility of the Contractor to provide same as well as to provide material and equipment usually furnished with such systems or required to complete the installation, whether mentioned or not.

L. Should a discrepancy exist between the Mechanical Drawings and the Mechanical Specifications it is the Contractor’s responsibility to include that

portion or portions of the more expensive item in bid proposal. Final approval and/or directive can then be forwarded to the Contractor during the submittal process.

1.11 FIXTURE AND EQUIPMENT SIZES AND REQUIREMENTS

A. Space allocations in machinery spaces are based on equipment scheduled in each case. Should the Contractor offer equipment of another make that requires more space in any critical dimension, the Contractor shall submit, together with other submittal data on the equipment, prints of drawings indicating how the equipment may be installed, indicating room for servicing and revisions in piping or ducting and any other details necessary for the Owner's representative to form a judgment as to the suitability of the substitute material, as to performance, suitability for the space and other variables.

B. Duties of certain equipment items, horsepower of driving motors and electrical characteristics are scheduled for equipment items of a particular make in each case. Should any substitute material be accepted which has other requirements that would involve allied equipment or the work of others, the Contractor shall be responsible for all modifications required at no change in contract price. As examples:
   1. If an accepted A/C Unit has a brake horsepower requirement above the motor horsepower scheduled, the Contractor shall be responsible for providing a larger motor and heavier drive and any change in size of the protective device, conduit run, and conductors serving that motor. The latter shall be extended through an individual branch protective device and branch circuit on through the panel, feeder, feeder protective device, etc.
   2. If accepted heat exchangers, coils, etc. have greater pressure drops than those on which pumping heads were based, the Contractor shall be responsible for selecting proper pumps and drive and adjusting the electrical work as required.

C. Structural steel members are indicated to provide supports for certain specific sizes and weights of equipment. Should other equipment be offered, the spacing of the supports shall be varied to suit the equipment. Should the weight or size of a substituted item of equipment require additional supporting steel members, the Contractor shall be required to provide and install them at no change in contract price.

1.12 INTERFACE WITH OTHER PRODUCTS

Review millwork shop drawings. Confirm location and size of equipment and openings before ordering equipment, rough-in, and installation.

1.13 SUBMITTALS

A. Submit in timely manner for review, brochures describing all materials, equipment, fixtures, and specially fabricated structures proposed for use in the performance of the work on this Project. Comply with Section 01 30 00.
   1. Items to be submitted shall include, but shall not be limited to, ductwork, pipe, valves, fittings, materials, hangers, special supports, insulation, fixtures, equipment, controls, coordination and ductwork fabrication drawings, central plant coordination and piping fabrication drawings, and mechanical room layouts.
   2. Contractors Coordination Drawings: The Contractor shall prepare a complete set of coordination drawings indicating the equipment actually purchased and the exact routing for piping, conduit, and ductwork. The elevations, locations, support points, load imposed on the structure at support and anchor points, and size of all lines shall be indicated. All beam penetrations and slab penetrations shall be indicated and sized and shall be coordinated. This requirement for coordination drawings shall not be construed as authorization for the Contractor to make any unauthorized changes to the Contract Drawings. All Design Drawing space allocations shall be maintained, such as ceiling height, chase walls, equipment room size, and the like, unless proper written authorization is received from the Architect to change them.

B. Submit manufacturer's data or shop drawings where required by a Section covering a particular system and/or piece of equipment. The manufacturer's data of shop drawings shall include, but not be limited to, giving full information as to dimensions, weight, materials, motor sizes, electrical characteristics, wiring diagrams, capacities and all information pertinent to adequacy of items. Contractor is responsible for the timely preparation and submission of ¼”=1’-0” ductwork shop drawings indicating all items necessary for complete coordination and fabrication/installation. Contractor is also responsible for the timely preparation and submission of ½”-1’-0” shop drawings indicating all HVAC equipment, piping, and ductwork in mechanical room areas and or critical areas that mandate a thorough review of the systems. Engineer will review these drawings for compliance and offer comments and or suggestions.

C. Information shall be presented so that line-by-line comparison may be made with Contract Documents. Deviation from Contract Documents shall be enumerated on a separate sheet and so entitled. Data of general nature will not be acceptable.

D. Each submittal will be reviewed for compliance with general requirements of design and arrangement only; it is not a Contract Document and acknowledgment of compliance does not remove the Contractor of responsibility for performance of the work in compliance with all provisions and requirements of the Contract Documents. Job measurements and the coordination of all the dimensions for proper fit of all parts of the work and

performance of all equipment supplies to meet Specification requirements are and remain specific responsibilities of the Contractor.

E. Each submittal shall be neatly organized with information arranged in order of specification section. Submit Plumbing, Fire Protection, and HVAC divisions independently with a maximum of three (3) separate packages for each division, as example, major equipment, materials, and controls. Each brochure shall be neatly organized (i.e. separate tabs for each section with a corresponding Table of Contents) into a single binder or electronic PDF file to include all proposed equipment in a single submission for each package. In each brochure or electronic file provide cover sheet identifying project name and location, Architect, Engineer, General Contractor, and Mechanical Contractor. Include Contractor's addresses and phone numbers. Provide adequate space for Architect's and Engineer's stamps. Contractor shall include and sign the following statement of compliance on the cover sheet:

I hereby certify that this shop drawing and/or brochure has been checked prior to submittal and that it complies in all respects with the requirements of the Contract Documents for this project.

(Company Name)
Signed
Date

Submittals forwarded without compliance statement and signature in each brochure will not be reviewed. Contractor will bear the risk of all delays, as if no submittal had been delivered.

Contractor’s statement of compliance shall constitute a representation to the Owner’s representative that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each submittal with the requirements of the work and the Contract Documents.

F. Engineer’s review of submittals does not relieve Contractor of his responsibility for deviations from Contract Documents or errors and omissions except when acceptance of the specific deviation is given in writing.

G. Engineer’s review and approval is only for conformance with the design concept of the project and for compliance with the information given in the contract.
   1. The review shall not extend to means, methods, sequences, techniques, or procedures of construction or to safety precautions or programs incident thereto.
   2. The review shall not extend to review of quantities, dimensions, weight or gauges, fabrication processes or coordination with the work of other trades.

H. The shop drawings are not intended to cover detailed quantitative lists of heating specialties, valves, air distribution devices, fixtures, and similar items. It is the Contractor's responsibility to procure the proper quantities required to comply with the established requirements.

I. Coordinate exact electrical requirements of HVAC equipment and fixtures with Electrical Division prior to submittal of brochures.

J. Submit brochures in sufficient time and of proper format so as to avoid delays or changes in construction. Failure to comply shall render Contractor liable for expenses of delays occasioned by failure to provide necessary information or drawings. Owner’s representative reserves the right to contact manufacturer directly to secure proper data and detail when deemed necessary. Contractor shall be liable for costs incurred by such action.

K. Any shop drawings prepared to illustrate how equipment, piping, ducts, and the like are to be fitted into available spaces will be examined under the assumption that the Contractor has verified all the conditions, and obtaining any approval thereon shall not relieve the Contractor of responsibility in the event the material cannot be installed as shown on those drawings.

L. Any material or equipment installed without the Owner representative's prior approval shall, if so directed by the Owner's representative, be removed and replaced with approved material or equipment at the Contractor's expense.

M. Any dimensional changes or rerouting of piping or ductwork shall necessitate submittal or shop drawings of the system under consideration prior to fabrication or erection of material. Drawings will be utilized by the Owner's representative to evaluate the effect of the proposed changes on equipment performance.

N. Test Reports: The Contractor shall submit to the Owner's representative all test reports in accordance with details specifically called for in the various Sections of the Specifications in this Division.

1.14 COMMISSIONING OF HVAC SYSTEMS

Upon completion of the HVAC installation, Contractor shall test, balance, adjust, and operate all individual components of the HVAC system. Demonstrate that the installation is functioning in all modes of operation as a complete and integrated HVAC system and is performing in accordance with the Contract Documents. Owner’s personnel shall be trained in the operation and maintenance of the system. All operating schedules, parameters, and set-points shall be entered into the Facility Management System or Automatic Temperature Control system.

1.15 OPERATION OF HVAC SYSTEMS

It is the intent of the HVAC system design to operate HVAC systems continuously, 24 hours a day, 365 days a year, in either occupied or unoccupied modes of

operation as described in Section 23 09 93 to provide for control of space temperature and humidity.

1.16 OPERATION AND MAINTENANCE INSTRUCTIONS

A. Upon completion of work, provide three (3) sets of complete operations and maintenance instructions of mechanical equipment, neatly bound in 3 ring binders. Provide each binder with the name of Owner, Architect/Engineer, Contractor, and Title. During the construction period, accumulate the following for inclusion in the Operating and Maintenance Manuals:
   1. Tabulation of equipment by manufacturer, model number, and serial number.
   2. All warranties and guarantees and manufacturer's directions on equipment and material covered by the Contractor.
   3. Approved fixture brochures, wiring diagrams, and control diagrams.
   4. Copies of shop drawings and submittals.
   5. Operating instructions for all mechanical equipment and systems. Operating instructions shall include maintenance and seasonal changeover procedures.
   6. Recommended maintenance procedures.
   7. Repair parts list of all major items and equipment including name, address, and telephone number of local supplier or agent.
   8. Valve tag charts and diagrams specified elsewhere herein.
   9. Manufacturer’s letter certifying that the equipment has been installed per manufacturer’s installation manuals.
   10. Contractor’s one (1) year warranty letter including start and finish dates.

B. Operation and Maintenance instructions shall be submitted and approved prior to instruction of Owner's personnel in the various systems operation and maintenance.

1.17 UTILITIES

The Contract Documents reflect the general location, size, and manner of routing for all utilities known to be required on this project. It shall be the responsibility of the Contractor to visit the site, meet with the local Utility Company personnel in order to coordinate and confirm the exact requirements for all utilities. The bid submitted by the Contractor shall include costs for all such coordination work as well as any and all utility company charges and/or fees.

1.18 BUILDING CONSTRUCTION AND LAYOUT OF WORK

The Contract Documents are diagrammatic in character and cannot show every connection in detail or every line or conduit its exact location. These details are subject to the requirements of ordinances and also Structural and Architectural conditions. The Contractor shall carefully investigate structural and finish conditions and shall coordinate the separate trades in order to avoid interference between the various phases of work. Work shall be laid out so that it will be concealed in furred chases unless specifically noted or indicated to be exposed. Work shall be installed

to avoid crippling of structural members; therefore, inserts to accommodate hangers shall be set before concrete is poured, and proper openings through floor, walls, beams, etc. shall be provided as hereinafter specified or as otherwise indicated or required before concrete is poured. All work shall be run parallel or perpendicular to the lines of the building unless otherwise noted.

1.19 RECORD DRAWINGS

A. As part of the required mechanical work, a complete set of record drawings shall be made up and delivered to the Owner's representative.

B. The drawings shall reflect the following:
   1. All mechanical work installed exactly in accordance with the original design.
   2. All mechanical work installed as a modification or addition to the original design.
   3. The dimensional information necessary to delineate the exact location of all ductwork and piping runs which are so concealed as to be untraceable by inspection through the regular means of access established for inspection and maintenance. Where shop drawings have been prepared and approved, the record drawings shall be cross referenced to the respective shop drawings. In this case dimensions need not be shown on the record drawings.

C. Record drawings shall include the updating of all equipment schedules.

D. The record drawings shall be of a reproducible type as directed.

1.20 WARRANTY

A. All materials and equipment, to be furnished and installed under this Division of the Specifications shall be warranted to meet the specified performance requirements and to be free of defects in materials and workmanship for a period of one year after final acceptance. HVAC Contractor is responsible for warranty period beginning at final acceptance of all equipment regardless of equipment start-up date. The Contractor to the complete satisfaction of the Owner’s representative shall remedy deficiencies caused by other than normal usage, without cost to the Owner or Design Professionals.

B. If there is any indication that the equipment does not meet the specified quantities, the Contractor shall, at his expense, institute a program to demonstrate the adequacy of the installation. This program shall include all necessary testing and testing equipment. Should the Contractor not have the equipment or technical skill to perform the tests, it shall be his responsibility to employ recognized experts to perform the tests and shall provide certified laboratory tests, certified factory reports and work sheets, or other certified data to support results of any tests required.

1.21 BILLINGS

Contractor shall provide a schedule of values of the mechanical work with each payment application. Provide a line item for labor and materials for each section of specifications. Provide additional breakdown where requested by Owner's Representative.

PART 2 PRODUCTS

2.1 EQUIPMENT

Coordinate exact electrical requirements of mechanical equipment prior to submittal and purchase. Equipment that is not compatible with electrical installation will be removed and replaced at no expense to the Owner or Design Professionals.

2.2 MATERIALS

A. Unless otherwise specified, provide only new, first grade equipment and materials which comply with requirements of this Specification and applicable Standards.

B. Furnish, if required, satisfactory evidence of kind and quality of materials proposed for use.

C. Similar items of material and equipment shall be product of same manufacturer.

2.3 SUBSTITUTIONS

A. The Specifications indicate a standard of quality for materials. Manufacturer's names and catalog numbers are used to designate materials or equipment to establish grade and quality. Where several manufacturers are named, the bid shall be based on those named manufacturer's products. Where only one manufacturer is named, unless stated otherwise, manufacturers of equal quality products will be considered as substitutions only if submitted at least 5 days before the bid date and when in compliance with all criteria set forth within Section 2.3:
   1. Contractor is responsible for all coordination and additional costs which may be required for the work to be completed on time with no additional cost to the Owner or Design Professionals.
   2. Contractor to verify during submittal that the product works dimensionally within the intent of the design.
      a. The ability to service components shall not be compromised.
      b. Any additional coordination due to interference with other elements of the project will be the responsibility of the Contractor with no additional cost to the Owner or Design Professionals.
   3. Comply with Section 01 60 00.

B. It is fully the Contractor's responsibility to assemble and submit sufficient technical information to fully illustrate that the material or equipment proposed for substitution is equal or superior as the Architect or Engineer is under no obligation to perform the service for the Contractor. The proposal shall be accompanied by manufacturer's complete engineering data, specification sheet, and a sample, if practical or if requested. In no event shall a proposal for substitution be cause for delay of work.

C. Substitutions and deviations shall be clearly marked, indicated, or otherwise called to attention of the Owner's representative in the submittal documents. Failure to indicate substituted materials and/or equipment or deviations from Contract Documents shall be construed as a representation that contractual obligations have not been meet and the submittal shall be rejected without further review.

D. Engineer reserves the right to accept or reject proposed substitutions and it is understood that his judgment shall be final.

2.4 ELECTRICAL MOTORS

A. All motors furnished under any of the several Sections of these Specifications shall be of recognized manufacturer, of adequate capacity for the loads involved, and wound for the electrical characteristics indicated on the Drawings or specified herein. Verify all job site voltages and power source available before installation of any motor or controls. All motors shall conform to the standards of manufacture and performance of the National Electrical Manufacturers Association (NEMA) as shown in their latest publication. All motors shall be furnished with open-frame, unless otherwise noted, or required by NEC for the service conditions encountered.

B. Unless otherwise noted, fractional motors rated at less than 1/2 horsepower shall be single phase, the motors rated at 1/2 horsepower or larger shall be three phase. Single phase motors shall be arranged for across-the-line starting. Motors exposed to weather shall be totally enclosed and weatherproof. Single phase motors shall be capacitor start, induction run type and shall be furnished with motor controller with pilot light where scheduled or indicated.

C. Except as otherwise specified, open motors over one (1) horsepower shall be drip proof, squirrel cage, high efficiency type similar or equal to Reliance XE, Century E Plus III, Baldor Super E or General Electric Energy Saver, NEMA Design B, induction type rated for constant duty with 40 Deg. C. temperature rise. Furnish submittal data on all high efficiency motors furnished to include motor efficiencies as rated in accordance with IEEE Standard 112, Test Method B. Motors under one (1) horsepower shall be same as described herein, but standard efficiency rating.

D. All motors shall be of the same manufacturer unless they are an integral part of the piece of equipment to which they are attached.

2.5 MOTOR CONTROLLERS AND ELECTRIC INTERLOCKS

A. Except where otherwise specified or as included as an integral part of the normal and customary mechanical equipment, each starter shall be furnished by other divisions complete with the required control power transformers and auxiliary contacts necessary for control interlocks and wired by a licensed electrician in accordance to governing codes.

B. In Fractional horsepower 120v-single phase roof or wall mounted fans, a motor rated manual starter/disconnect with on-off snap switch type with soldered ratchet overload protection shall be furnished by the Contractor furnishing the fans and wired by a licensed electrician in accordance to governing codes.

C. When interlocking of equipment is required all wiring in excess of 50 volts to be provided by a licensed master electrician and coordinated by the Contractor. All other wiring 50 volts or less or as required by the controls/energy management system shall be fully coordinated by the Contractor to provide and assure a complete and fully operational system. All conduit for controls and or power wiring shall be in accordance with Division 16 requirements, and installed by licensed electrician and coordinated by the Contractor.

D. Except for such items that are normally wired up to their point of manufacture and so delivered and unless specifically noted to the contrary herein, the Contractor shall do all electric wiring of every character for interlocking, pilot, and control in accordance with methods and materials described within Division 26 of these Specifications. This includes conduits and mounting of all electrical devices.

E. Furnishing of complete wiring diagrams showing proper control and interlock wiring shall be work under the trade supplying the equipment. Diagrams shall be based on the approved equipment for this project and shall be complete integral drawings, not a series of manufacturers' individual diagrams.

F. The electrical design and drawings are based on the equipment scheduled and shown on the mechanical Drawings and should any mechanical equipment requiring changes to the electrical design be approved, the required electrical changes shall be made at no cost to the Owner.

2.6 CONTROL POWER AND EQUIPMENT POWER FOR CONTROLS

A. Control power, whether it be DDC, 24 volt, or 120 volt, should be delivered to each piece of mechanical equipment, fire/smoke dampers, and/or control panels whether or not it is specifically indicated on the Contract Drawings.

B. It is the Contractor's responsibility to include in his or her bid all costs in connection with control wiring, and/or power, whether or not it is specifically indicated. Regardless of how large in nature or how incidental, no additional

compensation will be approved by the Owner's representative or Design Professionals concerning a failure on the Contractor's part to include these costs in bid proposal or a failure on the Contractor's part to properly coordinate these important functions.

C. All control wiring in mechanical, electrical rooms or exposed to be installed in raceways. All other wiring to be installed neatly and inconspicuously per local code requirements. If local code allows, control wiring above accessible ceiling spaces may be run with plenum rated cable (without conduit). All conduits outdoors shall be EMT with rain tight fittings. Line voltage control wiring shall be run in EMT.

2.7 SAFETY GUARDS

A. Provide safety guards for moving equipment such as fan belt drives and motor drive couplings.

B. Use OSHA approved belt guards and couplings guards. Provide 1/2 inch hole in guard at center of shaft of driven equipment where belt type drives are used.

PART 3 EXECUTION

3.1 PRODUCT HANDLING, RECEIVING, INSPECTION, AND STORAGE

A. Handling and Receiving: The Contractor shall receive and handle all materials and equipment with care so as not to cause damage. Use padded or strap slings, etc. as appropriate for the items being handled. Lift materials and equipment by lift points provided or recommended by the manufacturer.

B. Inspection: The Contractor shall upon receipt, inspect all materials and equipment for defects, damage, and compliance with the Specifications. When materials and equipment are received in acceptable condition, assume full responsibility for its storage, handling, and installation. Materials and equipment found to be incomplete or damaged shall be reported to the Carrier and Owner's representative immediately, within a maximum of three (3) days, for its replacement.

C. Identification: Upon receipt of all materials and equipment, the Contractor shall identify and tag, stencil, or otherwise permanently identify all materials and equipment with the appropriate equipment number.

D. Storage: Materials and equipment, which cannot be installed immediately after delivery, shall be stored in a safe, dry location provided by the Contractor. Materials and equipment damaged or stolen while in storage shall be replaced by the Contractor at no cost to the Owner.

3.2 COORDINATION WITH OTHER DIVISIONS AND OWNER

A. General: Cooperate to fullest extent with other Divisions and Owner to the end that all work shall be executed economically without delay and that it will not interfere with their operations.

B. Progress Schedule: Contractor shall inform himself of progress schedules of all Divisions and shall work in accordance with schedules for completion of work.

C. Examine work of other trades that comes in contact with or is covered by this work. Do not attach to, cover, or finish against any defective work, or install work of this Division in a manner which will prevent other trades from properly installing their work. Consult all Drawings, Specifications, and details of other Divisions of the work.

D. Do not install equipment with electrical characteristics that are not compatible with the electrical installation.

3.3 EQUIPMENT ACCESSORY REQUIREMENT

It shall be the Contractor's responsibility to assure all packaged equipment ancillary devices shall be completely wired, piped, and calibrated. All systems shall be commissioned for acceptance by the Owner.

3.4 INSTALLATION

A. Space And Equipment Arrangement:
1. All equipment shall be installed in a manner to permit access to parts requiring service and to comply with code-mandated and manufacturer required clearances. Contractor shall notify Owner’s representative prior to installation of any equipment where said clearances cannot be maintained for further direction.
2. Any large piece of apparatus which is to be installed in any space in the building, and which is too large to permit access through stairways, doorways, or shafts shall be brought to the job and placed in the space before the enclosing structure is completed. Following placement in the space, such apparatus shall be thoroughly and completely protected from damage as hereinbefore specified.

B. Materials and equipment installed under this Contract shall be new in every respect, and installed in a first-class manner in accordance with the manufacturer's recommendations and applicable codes and standards.

C. The Contractor shall plan and coordinate his Work to provide all equipment and materials necessary to provide the Owner with a neat, functional, and serviceable installation.

D. The Contractor shall protect all work, materials, and equipment against damage until Final Acceptance by the Owner’s representative. Replace, or

repair to the satisfaction of the Owner's representative, any work, materials, or equipment that becomes damaged prior to Final Acceptance.

E. The Contractor shall make a detailed inspection of the work area and adjoining construction prior to beginning installation of any materials or equipment. Verify governing dimensions and other permissible dimensional tolerances. The Contractor shall report in writing to the Owner's representative unsatisfactory conditions encountered; do not begin installation until conditions are correct. Beginning installation signifies acceptance of conditions.

3.5 CUTTING AND PATCHING

A. This Contractor shall coordinate with the General Contractor all necessary cutting and drilling of walls, floor, ceilings, etc. for the installation of new work or for modifications to the existing work, but no structural work shall be cut unless specifically approved by the Owner's representative. Patching and painting of surfaces as required shall be by the Contractor, unless specified hereinafter.

B. Cutting and patching or repairing of work in place, made necessary by the negligence of the Contractor or anyone employed by him, shall be paid for by the Contractor.

3.6 EXISTING FACILITIES

The Contractor shall be responsible for loss or damage to the existing facilities as used by him and his workmen, and shall be responsible for repairing or replacing such loss or damage. The Contractor shall send proper notices and receive written permission from the Owner’s representative to enter existing areas. The Contractor before beginning work in existing areas shall make necessary arrangements and perform other services required for the care, protection, and in service maintenance of all electrical, communication, plumbing, heating, air conditioning, and ventilating services for new and existing facilities. The Contractor shall erect temporary barricades with necessary safety devices, as required to protect personnel from injury, removing all such temporary protection upon completion of the work.

3.7 OUTAGES

Outages of services as required by the project will be permitted, but only at a time approved by the Owner. The Contractor shall notify the Owner in writing two weeks in advance of the requested outage in order to schedule required outages. No outages shall be taken unless written approval has first been received from the Owner. The time allowed for outages will not be during normal working hours unless otherwise approved by the Owner. All costs of outages, including overtime charges, shall be included in the contract amount.

3.8 CONNECTION OF EQUIPMENT FURNISHED BY OTHERS

A. The Mechanical Division shall provide all mechanical connections to equipment furnished by other Divisions or the Owner that require service connections and/or ductwork.
   1. The Mechanical Division shall furnish materials and labor required for the connection of equipment except where indicated on Drawings as furnished by others.

B. The respective supplier shall furnish proper roughing-in diagrams for the installation of these items. All items shall be roughed-in and connected in strict accordance therewith.

3.9 INSPECTIONS

Contractor shall arrange for all inspections required by local building officials and state agencies. Correct deficiencies required to comply with codes and standards and to receive certificate of occupancy. Upon completion of this project, submit written evidence of compliance with the above to Owner's representative. Final acceptance will not be issued and the warranty date will not be established until such compliance is demonstrated.

3.10 SYSTEMS START-UP

A. Upon completion of the installation of the work, start-up all mechanical systems and test, balance and adjust systems until they are fully operational and functioning as intended by Engineer.

B. Do not start-up or operate HVAC systems until construction of building envelope is complete and system components will not be subjected to damage from dirt, dust, construction debris, and weather. Provide temporary caps on ductwork and piping to prevent entry of debris. Where adequate protection is not provided, all systems shall be cleaned or replaced to the satisfaction of the Owner.

C. Refer to Specification 23 05 10 for additional start-up requirements.

3.11 FINAL CONSTRUCTION REVIEW

A. Schedule: Upon completion of the Contract, there shall be a final construction review of the completed installation. Prior to this walk through, all work under this Division shall have been completed, tested, balanced and adjusted in final operating condition and the test report shall have been submitted to and approved by the Owner's representative.

B. Personnel: A qualified person representing the Contractor must be present at this final construction review to demonstrate the system and prove the performance of the equipment.

C. The building mechanical system shall have been in operation for a minimum of fifteen (15) days after Test and Balance work is complete prior to this review.

3.12 Equipment and System Operational Verification

A. Provide factory startup, testing and operational verification and controls verification of all major HVAC components (e.g. air handlers, condensing units, fans, etc.) by an equipment manufacturer's factory employed technician. Submit startup and operation verification reports to Architect and Engineer for review within 10 working days after the startup/verification is performed.

B. Applicable Equipment: Air handling units, Air Cooled Condensing Units, Kitchen Hood/Exhaust/Supply Equipment Systems, Mini-split Air Conditioning System.

3.13 CERTIFICATIONS

A. Before receiving final payment, the Contractor shall certify that all equipment furnished and all work done is in compliance with all applicable codes mentioned in these Specifications and with manufacturer’s requirements.

B. Certification is specifically required from the following:
1. Leak test of all new piping systems.
2. Pressure test of all new pressure piping systems.
3. Sterilization of all new water piping systems.
4. Equipment performance tests.

3.14 FASTENERS AND ANCHORS

A. Fasteners and Anchors:
1. General Requirements:
a. All types of “Powder-Actuated” fastening systems, “Hammer Drive” fastening systems, “Ram-Set” systems and similar type fastening systems are strictly prohibited from use on the project for permanent or temporary fasteners into permanent building components, except as indicated on the Drawings.
b. All types of permanent or temporary fastening systems or components which are not removable without damage to permanent building components are strictly prohibited from use (example: concrete nails, clinched double nails in concrete pilot holes, rawl spikes, zemac nailins, etc.).
c. Wedge type expansion anchors are prohibited at all locations where wedging action would cause spalling or damage to permanent building components, except as indicated on Drawings.
d. Plastic or nylon sleeves, nailins, plugs, cores, etc. are not acceptable as fastener components where exposed to weather.

e. All fasteners, and other components exposed to weather or in exterior locations must be hot-dip galvanized steel, stainless steel, monel or other approved corrosion – resistant material or finish. Cadium-plated or electro-galvanized finishes are not acceptable.

f. All fasteners installed in or in contact with type ACQ treated lumber (Yellawood) must be type 304 or Type 316 stainless steel or be specifically approved for installation in ACQ treated materials.

g. Regardless of fastening system utilized, the Contractor is responsible for sizing, frequency and spacing of fasteners according to substrate, load conditions and acceptable engineering practices.

2. Bolts, Nuts, and Washers: ASTM A325, galvanized to ASTM A153 for galvanized components.
3. Hardened Steel Self-Threading Screw Anchor ("Tapcon" Anchors): Anchorage to solid or hollow masonry and concrete.
4. Epoxy Resin Adhesive Type: Threaded studs in concrete, brick or concrete masonry.
5. Buildex TEKs self-drilling screws or type required for anchorage to steel.
6. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.

END OF SECTION

SECTION 23 05 10
STARTING OF PLUMBING AND HVAC SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Starting of Plumbing and HVAC Systems.

B. Demonstration and Instructions.

C. Dehumidification of Building.

D. Testing, Adjusting, and Balancing.

E. Commissioning of HVAC Systems.

1.2 RELATED SECTIONS

A. Section 23 05 93 – Testing, Adjusting, and Balancing.

B. Section 23 09 93 – Sequence of Operation.

C. All Divisions of Contract Documents.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 STARTING OF PLUMBING AND HVAC SYSTEMS

A. Coordinate schedule for start-up of various equipment and systems.

B. Notify Owner’s representative seven (7) days prior to start-up of each item.

C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, or for other conditions that may cause damage.

D. Do not start-up or operate HVAC systems until construction of building envelope is complete and system components will not be subjected to damage from dirt, dust, construction debris, and weather.

E. Clear dirt, dust, and grout from equipment on exterior of casings, interior surfaces, heating and cooling coils, and the like, and interior surfaces of ductwork prior to acceptance by Owner.

F. Verify that tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

G. Adjust electrical amp draw on motors to within 80% of rated amp draw.

H. Verify wiring and support components for equipment are complete and tested.

I. Execute start-up under supervision of applicable manufacturer's representative in accordance with manufacturers' instructions.

J. Activate and operate all HVAC equipment and systems and verify that the system is functioning properly in all modes and sequences of operation. When verification is complete, demonstrate all modes and sequences to Owner’s representative.

K. Activate and operate all plumbing equipment and systems and verify that all systems are functioning properly in all modes and sequences of operation. When verification is complete, demonstrate all modes and sequences to Owner’s representative. Verify hot water temperature settings, relief valve operation, pressure regulator operation, gas regulator operation, tempered water settings, temperature and pressure balancing valve operation, flue damper operation, combustion efficiencies, flush valve operation, and the like.

L. When specified in individual Specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

M. Adjust return air to 500 fpm at each air unit inlet.

N. Replace drive packages as necessary to achieve design air flows.

O. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.2 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of plumbing and HVAC equipment and systems to Owner's personnel two (2) weeks prior to date of final inspection.

B. Demonstrate project equipment and provide instruction by a qualified manufacturers' representative who is knowledgeable about the Project.

C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six (6) months.

D. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owners' personnel in detail to explain all aspects of operation and maintenance.

E. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at agreed time, at equipment location.

F. Prepare and insert additional data in operation and maintenance manuals when need for additional data becomes apparent during instruction.

G. Record training sessions on video tape and provide copy to Owner.

3.3 DEHUMIDIFICATION OF BUILDING

Start-up of cooling systems shall be accomplished in such a manner as to cool and dehumidify the space without the formation of condensation on building surfaces and elements, furniture, equipment, or appurtenances. Precautions should be taken by the contractor not to allow excessive humidity to develop in the building prior to final connection and activation of the HVAC system. Should it become necessary, the contractor shall procure the required equipment to properly dry and dehumidify the space so as not to force the HVAC to perform beyond its intended ability. Should damage occur due to start-up procedures, contractor shall be responsible for all costs associated with repair or replacement of damaged elements.

3.4 HVAC TESTING, ADJUSTING, AND BALANCING

A. General Contractor will secure the services of an independent firm to perform testing, adjusting, and balancing, as specified in Section 23 05 93 – Testing, Adjusting, and Balancing.

B. The contractor and the independent firm will perform services specified in Section 23 05 93 – Testing, Adjusting, and Balancing.

C. Reports will be submitted by the testing agency to the Owner’s representative indicating observations and results of tests and indicating compliance or non-compliance with the requirements of the Contract Documents.

D. HVAC Contractor shall refer to Section 23 05 93 Testing, Adjusting and Balancing for responsibilities.

3.5 VERIFICATION OF HVAC SYSTEMS

A. Upon completion of the HVAC installation, contractor shall test, balance, adjust, and operate all individual components of the HVAC system. Demonstrate that the installation is functioning in all modes of operation as a complete and integrated HVAC system and is performing in accordance with the Contract Documents. Owner’s personnel shall be trained in the operation and maintenance of the system. All operating schedules, parameters, and set-points shall be entered into the Facility Management System.

B. Provide factory startup, testing and operational verification and controls verification of all major HVAC components (e.g. air handlers, condensing units, fans, etc.) by an equipment manufacturer's factory employed technician. Submit startup and operation verification reports to Architect and Engineer for review within 10 working days after the startup/verification is performed

END OF SECTION

SECTION 23 05 29
HANGERS AND SUPPORTS

PART 1 GENERAL

1.1 SUMMARY

Section includes pipe and equipment supports, hangers, bases, sleeves and sealing of work to adjacent construction.

1.2 SUBMITTALS

A. Section 23 05 00 – Mechanical General Conditions: Submittal Procedures.

B. Shop Drawings: Indicate system layout with location and detail of trapeze hangers.

C. Product Data: Submit manufacturers catalog data including load capacity.

D. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.

E. Manufacturer's Installation Instructions: Submit special procedures and assembly of components.

1.3 QUALITY ASSURANCE

A. Perform Work in accordance with code for piping support and in conformance with NFPA 13 and 14 for support of sprinkler piping and standpipes.

B. Perform Work in accordance with AWS D1.1 for welding hanger and support attachments to building structure.

PART 2 PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Manufacturers:
1. Elcen.
2. Midland-Ross.
3. Michigan Hanger Co.
4. Sioux Chief.
5. ITT Grinnell.
6. B-Line.
7. Substitutions: Section 23 05 00 – Mechanical General Conditions.

B. Plumbing Piping – DWV and Storm Drainage:
1. Conform to ASME B31.9 ASTM F708.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron or Carbon steel, adjustable swivel, split ring.

3. Hangers for Pipe Sizes 2 inches and Over: Carbon steel, adjustable, clevis.
4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
5. Wall Support for Pipe Sizes to 3 inches: Pipe clamps and channel bracing secured to wall framing.
6. Wall Support for Pipe Sizes to 4 inches and over: Welded steel bracket and wrought steel clamp.
7. Vertical Support: Steel riser clamp.
8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
9. Copper Pipe Support: Copper-plated, carbon-steel adjustable, ring.
10. Piping Concealed in Stud Walls: Galvanized steel or copper plated stud brackets.

C. Plumbing Piping - Water:
1. Conform to ASME B31.9 ASTM F708.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron or Carbon steel, adjustable swivel, split ring.
3. Hangers for Cold Pipe Sizes 2 inches and Over: Carbon steel, adjustable, clevis.
4. Hangers for Hot Pipe Sizes 2 to 4 inches: Carbon steel, adjustable, clevis.
5. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
6. Wall Support for Pipe Sizes to 3 inches: Pipe clamps and channel bracing secured to wall framing.
7. Wall Support for Pipe Sizes 4 inches and over: Welded steel bracket and wrought steel clamp.
8. Vertical Support: Steel riser clamp.
9. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
10. Copper Pipe Support: Copper-plated, Carbon-steel ring.
11. Copper Piping Concealed in Stud Walls: Copper plated stud brackets.

D. Condensate Drain/Refrigerant Piping:
1. Conform to ASME B31.9 ASTM F708.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron or Carbon steel, adjustable swivel, split ring.
3. Hangers for Pipe Sizes 2 inches and Over: Carbon steel, adjustable, clevis.
4. Copper Pipe Support: Copper-plated, carbon-steel adjustable, ring.
5. Piping in or on Walls: Galvanized steel channels with pipe clamps and insulation protection, Cooper B-line or equal.
6. Piping Above Ceiling: Galvanized channel trapeze supports with galvanized pipe clamps and insulation protection, Cooper B-line or equal.

E. Fire Protection Piping:
1. Conform to NFPA 13 NFPA 14.

2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron or Carbon steel, adjustable swivel, split ring.
3. Hangers for Pipe Sizes 2 inches and Over: Carbon steel, adjustable, clevis.
4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
5. Wall Support: Welded steel bracket and wrought steel clamp.
6. Vertical Support: Steel riser clamp.
7. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

2.2 ACCESSORIES

Hanger Rods: Hot dipped galvanized mild steel threaded both ends, threaded on one end, or continuous threaded.

2.3 PROTECTION OF HANGERS

A. Steel hangers, hanger rod, and appurtenances located in crawl spaces, ventilated mechanical rooms, unconditioned attics or exposed to outdoors shall be hot dipped galvanized.
   1. As an alternate method, components such as rollers, chairs, pipe stands, steel supports, etc., may be primed with PPG or equal Inhibitor Red Primer 6-208, and painted with two (2) coats of PPG or equal Enamel 54 Line.
   2. All surfaces to be painted shall be free of dust, rust, scale, grease, or other foreign material, and shall be dry at time of painting.

B. FLASHING – Coordinate and refer to Architectural for roofing type and flashing requirements.

C. Metal Flashing: 26 gage thick galvanized steel.

D. Metal Counterflashing: 22 gage thick galvanized steel.

E. Lead Flashing: Waterproofing: 5 lb./sq. ft sheet lead.

F. Flexible Flashing: 47 mil thick sheet butyl; compatible with roofing.

G. Caps: Steel, 22-gage minimum; 16 gage at fire resistant elements.

H. Plumbing Vents-Through-Roof (VTR): Refer to Part 3 EXECUTION, Paragraph 3.4 FLASHING.

2.4 EQUIPMENT CURBS

A. Manufacturers:
   1. RPS Corporation.
   2. Pate.
   3. Stiles.
   4. Thy Curb.

5. Substitutions: Section 23 05 00 – Mechanical General Conditions.

B. Fabrication: Welded 18 gage galvanized steel shell and base, mitered 3 inch cant, variable step to match roof insulation, 1-1/2 inch thick insulation, factory installed wood nailer. Curbs shall be 14 inches minimum above roofing surface. Construct to match pitch of roof.

C. Curbs to be constructed of materials that are dielectrically compatible with roof deck. Contractor to verify of curb and roof deck prior to submittal.

D. Refer to other sections of these specifications for additional requirements or special requirements suitable for that section's application.

2.5 SLEEVES

A. Manufacturers:
1. Pro Set.
2. Substitutions: Section 23 05 00 – Mechanical General Conditions.

B. Sleeves for Pipes through Non-fire Rated Floors: 18 gage thick galvanized steel.

C. Sleeves for Pipes through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.

D. Sleeves for Pipes through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed.

E. Sleeves for Round Ductwork: Galvanized steel.

F. Sleeves for Rectangular Ductwork: Galvanized steel.

G. Stuffing or Fire-stopping Insulation: Glass fiber type, non-combustible.

H. Sealant: Acrylic in non-fire rated application.

I. Where approved by Engineer prior to installation, at floor penetration of slab on grade construction, flexible foam pipe wrap such as "Flex-Wrap" by Cal-Western may be substituted for sleeve.

J. Cover trap primer piping embedded in concrete floors and walls with "Poly-Sleeve" or equal polyethylene sleeve material.

2.6 FIRE STOP SYSTEMS

A. Manufacturers:
1. 3m Model 2000.
2. Spec Seal Model 100.
3. Hilti.
4. Substitutions: Section 23 05 00 – Mechanical General Conditions.

B. General Purpose Fire Stopping Sealant: Water based, non-slumping, premixed sealant with intumescent properties, rated for 3 hours in accordance with ASTM E814 and UL 1479.

C. General Purpose Vibration Resistant Fire Stopping Sealant: Silicone based, non-slumping, premixed sealant with intumescent properties, vibration and moisture resistant, rated for 3 hours in accordance with ASTM E814 and UL 1479.

D. Plastic Pipe Systems Fire Stopping Sealant: Silicone based, premixed sealant with intumescent properties, vibration and moisture resistant, rated for 3 hours in accordance with ASTM E814 and UL 1479 with metal collars.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturers instructions.

B. Install cast iron piping in accordance with CISPI Standards.

3.2 PIPE HANGERS AND SUPPORTS

A. Install in accordance with ASME B31.9, ASTM708.

B. Support horizontal piping as scheduled.

C. Install hangers with minimum 1/2-inch space between finished covering and adjacent work.

D. Place hangers within 12 inches of each horizontal elbow.

E. Use hangers with 1-1/2 inch minimum vertical adjustment.

F. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.

G. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.

H. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.

I. Support riser piping independently of connected horizontal piping.

J. Provide copper plated hangers and supports for copper piping.

K. Design hangers for pipe movement without disengagement of supported pipe.

L. Support base of risers in crawl spaces or above ceilings with braces, blocks, rodding or other suitable method, to prevent movement of pipe or separation of joints and fittings.

M. Provide non-conducting dielectric connections wherever dissimilar metals come in contact such as between pipe and hangers or pipe and metal structure and wall studs.

N. Paint pipe and equipment supports exposed to weather with galvanizing paint or other approved method.

O. Where piping is suspended in excess of 18 inches, provide sway bracing to secure against horizontal movement.

P. Install hangers adjacent to motor driven equipment with vibration isolation; refer to Section 23 05 48 – Mechanical Sound and Vibration Control.

3.3 EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping pads of concrete, minimum 4 inches thick and extending 6 inches beyond supported equipment footprint. Steel members may be substituted for concrete pad where approved prior to installation, or as shown on Drawings.

B. Provide additional steel framing to raise equipment above housekeeping pad where necessary to properly construct p-traps and equipment drains.

C. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.

D. Construct supports of steel members. Brace and fasten with flanges bolted to structure.

E. Provide rigid anchors for pipes after vibration isolation components are installed.

3.4 FLASHING

A. Provide flexible flashing and metal Counterflashing where piping and ductwork penetrate weather or waterproofed walls and floors.

B. Flash vent and soil pipes projecting 10 inches minimum above finished roof surface with lead worked 1 inch minimum into hub, 12 inches minimum clear on sides with 24 x 24 inches sheet size. For pipes through outside walls, turn flanges back into wall and caulk, metal counter-flash, and seal. At metal roofs, provide dielectrically compatible flashing. Coordinate actual flashing requirements with Architect.

C. Flash floor drains in floors with topping over finished areas with lead, 10 inches clear on sides with minimum 36 x 36 inch sheet size. Fasten flashing to drain clamp device.

D. Seal floor, shower, and mop sink drains watertight to adjacent materials.

E. Provide curbs for mechanical roof installations 14 inches minimum high above roofing surface. Flash and counter-flash with sheet metal; seal watertight. Attach Counterflashing mechanical equipment and lap base flashing on roof curbs. Flatten and solder joints.

F. Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

3.5 SLEEVES

A. Set sleeves in position in forms. Provide reinforcing around sleeves.

B. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

C. Extend sleeves through floors 2 inches above finished floor level. Caulk sleeves.

D. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with stuffing or fire stopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

E. Install chrome plated steel escutcheons at finished surfaces.

3.6 SCHEDULES

PIPE SIZE Inches	MAX. HANGER SPACING Feet	DIAMETER Inches
1/2 to 1-1/4	6.5	3/8
1-1/2 to 2	10	3/8
2-1/2 to 3	10	1/2
4 to 6	10	5/8
8 to 12	14	7/8
PVC (All Sizes)	6	3/8
C.I. Bell and Spigot (or No-Hub) And at Joints	5	5/8”

END OF SECTION

SECTION 23 05 48
MECHANICAL SOUND AND VIBRATION CONTROL

PART 1 GENERAL

1.1 SUMMARY

Section includes vibration isolation.

1.2 PERFORMANCE REQUIREMENTS

A. Provide vibration isolation on motor driven equipment 0.5 hp and over, plus connected piping and ductwork.

B. Provide minimum static deflection of isolators for equipment as follows:
   1. All:
      a. Under 400 rpm: as recommended by manufacturer.
      b. 400 - 600 rpm: 3.5 inch.
      c. 600 - 800 rpm: 2 inch.
      d. 800 - 900 rpm: 1 inch.
      e. 1100 - 1500 rpm: 0.5 inch.
      f. Over 1500 rpm: 0.2 inch.

1.3 SUBMITTALS

A. Section 23 05 00 - Mechanical General Conditions: Submittals.

B. Product Data: Submit schedule of vibration isolator type with location and load on each. Submit catalog information indicating, materials, dimensional data, pressure losses, and acoustical performance for standard sound attenuation products.

C. Manufacturer's Installation Instructions: Submit special procedures and setting dimensions.

1.4 CLOSEOUT SUBMITTALS

Project Record Documents: Record actual locations of ductwork lagging. Record actual locations of hangers including attachment points.

1.5 QUALITY ASSURANCE

Perform Work in accordance with AMCA 300, ANSI S1.13, ARI 575, ASA 16 (ANSI S1.36) standards and recommendations of ASHRAE 68.

PART 2 PRODUCTS

2.1 VIBRATION ISOLATORS

A. Manufacturers:
1. Amber Booth.
2. Mason Industries.
3. Kinetics.
4. Substitutions: Section 23 05 00 – Mechanical General Conditions.

B. Open Spring Isolators:
1. Spring Isolators:
   a. For Interior areas: Provide aluminum housings and plastic coated springs. For Exterior and Humid Areas: Provide hot dipped galvanized housings and neoprene coated springs.
   b. Code: Color code springs for load carrying capacity.
2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
3. Spring Mounts: Furnish with leveling devices, minimum 0.25 inch thick neoprene sound pads, and zinc chromate plated hardware.
4. Sound Pads: Size for minimum deflection of 0.05 inch; meet requirements for neoprene pad isolators.

C. Closed Spring Isolators:
1. Spring Isolators:
   a. For Interior areas: Provide aluminum housings and plastic coated springs. For Exterior and Humid Areas: Provide hot dipped galvanized housings and neoprene coated springs.
   b. Code: Color code springs for load carrying capacity.
2. Type: Closed spring mount with telescoping top and bottom housing separated with neoprene rubber stabilizers to limit horizontal motion. Provide elastomeric pad of minimum ¼" thickness bonded to the bottom of the base plate.
3. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
4. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, and neoprene side stabilizers with minimum 0.25 inch clearance.
5. Amber Booth Type XL, XLS or equal.

D. Spring Hanger:
1. Spring Isolators:
   a. Provide hot dipped galvanized housings and neoprene coated springs.
   b. Code: Color code springs for load carrying capacity.
2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.

3. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators.
4. Misalignment: Capable of 20 degree hanger rod misalignment.
5. Amber Booth Type BSSR or equal.

E. Neoprene Pad Isolators:
1. Rubber or neoprene-waffle pads.
   a. 30 durometer.
   b. Minimum ½ inch thick.
   c. Maximum loading 40 psi.
   d. Height of ribs: not to exceed 0.7 times width.
2. Configuration: ½ inch thick waffle pads bonded each side of ¼ inch thick steel plate.
3. Amber Booth Type SP-NRE or equal.

F. Rubber-in-Shear Hanger:
1. Isolators:
   a. Provide hot dipped galvanized housing and rubber-in-shear isolator.
   b. Amber-Booth Type HRD-1 or equal.

G. Rubber Mount or Hanger: Molded rubber designed for 0.5 inches deflection with threaded insert.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Lag ductwork at connections to fan powered boxes located above classrooms by wrapping with insulation and covering. Apply covering to be airtight. Do not attach covering rigidly to ductwork.

C. Install isolation for motor driven equipment.

D. Install spring hangers without binding.

E. On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.

F. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.

G. Connect wiring to isolated equipment with flexible hanging loop.

3.2 MANUFACTURER'S FIELD SERVICES

Inspect isolated equipment after installation and submit report. Include static deflections.

3.3 SCHEDULES

EQUIPMENT ISOLATION SCHEDULE

ISOLATED EQUIPMENT	
Air Cooled Condensing Units	Neoprene Pad
Air Handling Units	Closed Spring Isolators and Neoprene Pads
Suspended Exhaust Fans	Spring Hanger or Rubber Mount Hanger

END OF SECTION

SECTION 23 05 53
MECHANICAL IDENTIFICATION

PART 1 GENERAL

1.1 SUMMARY

Section includes nameplates, tags, stencils, and pipe markers.

1.2 SUBMITTALS

Section 23 05 00 – Mechanical General Conditions: Submittal Procedures.

1.3 CLOSEOUT SUBMITTALS

Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.

1.4 QUALITY ASSURANCE

A. Materials: Flame spread/smoke developed rating of 25/50 or less in accordance with ASTM E84, NFPA 255, UL 723.

B. Maintain one copy of each document on site.

1.5 QUALIFICATIONS

Manufacturer: Company specializing in manufacturing products specified in this section with minimum three (3) years documented experience.

PART 2 PRODUCTS

2.1 NAMEPLATES

A. Manufacturers:
   1. Brady.
   2. Seton.
   3. LEM.
   4. Substitutions: Section 23 05 00 – Mechanical General Conditions.

B. Product Description: Laminated three-layer plastic with engraved black letters on light contrasting background color.

2.2 TAGS

A. Metal Tags:
   1. Manufacturers:
      a. Brady.
      b. LEM.
      c. Seton.

d. Substitutions: Refer to Section 23 05 00 – Mechanical General Conditions.

2. Brass with stamped letters; tag size minimum 1-1/2 inches diameter with finished edges.

B. Tag Chart: Typewritten letter size list of applied tags and location in anodized aluminum frame.

2.3 PIPE MARKERS

A. Color and Lettering: Conform to ASME A13.1.

B. Plastic Pipe Markers:
1. Manufacturers:
a. Brady.
b. LEM.
c. Seton.
d. Substitutions: Refer to Section 23 05 00 – Mechanical General Conditions.
2. Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.

2.4 CEILING TACKS

A. Manufacturers:
1. Brady.
2. LEM.
3. Seton.
4. Substitutions: Section 23 05 00 – Mechanical General Conditions.

B. Description: Steel with 3/4-inch diameter color-coded head.

PART 3 EXECUTION

3.1 PREPARATION

Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

A. Install identifying devices after completion of coverings and painting.

B. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.

C. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer.

D. Install tags using corrosion resistant chain. Number tags consecutively by location.

E. Equipment: Identify air handling units, domestic water heaters, fans, kitchen hood and other mechanical equipment with plastic nameplates. Identify pumps and other small devices with tags. Air devices do not require mechanical identification.

F. Identify control panels and major control components outside panels with plastic nameplates.

G. Identify valves in main and branch piping with tags.

H. Tag automatic controls, instruments, and relays. Key to control schematic.

I. Piping: Identify piping, concealed or exposed, with plastic pipe markers. Identify service and flow direction. Identify domestic hot and cold water. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

J. Provide ceiling tacks to locate valves or dampers above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

SECTION 23 05 58
ACCESS DOORS

PART 1 GENERAL

1.1 WORK INCLUDED

Furnish and install access doors in wall or ceiling locations as required or shown for access to valves, controls, regulating devices, water hammer arrestors, trap-primers, cleanouts, air distribution devices and other equipment requiring maintenance, adjustment or operation.

PART 2 PRODUCTS

2.1 NON-FIRE RATED ACCESS DOORS

Furnish Inryco/Milcor, Acudor, Elmdor, or equal with 16 gauge frames, 14-gauge panels and 22-gauge casing head. Provide continuous concealed hinges and flush screwdriver cam lock. Use Style K access doors for plastered surfaces, Style M for masonry or gypboard surfaces. Use Style AP for acoustical plaster ceiling, with 18-guage panel and all-galvanized construction.

2.2 FIRE RATED ACCESS DOORS

Furnish Inryco/Milcor, Acudor, Elmdor, or equal, UL listed, 1-1/2 hour Label “B”, access doors with 16-gauge steel frames, and 20-gauge insulated sandwich-type door panel. Provide door with continuous concealed hinge and automatic closing and latching mechanism.

2.3 FINISHED AREAS

Provide stainless steel access doors where located in finished areas that are accessible to the general public such as but not limited to Toilet Rooms, Offices, Corridors, and Classrooms.

PART 3 EXECUTION

3.1 Not all required access doors are shown. Coordinate with the Contractor to locate access doors for ease of operation and maintenance of concealed equipment.

3.2 Installation shall be in accordance with the manufacturer’s printed instructions.

3.3 Access doors shall be of sufficient size to perform all necessary service and maintenance tasks.

END OF SECTION

SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Measurement of final operating condition of HVAC systems.

1.2 SCOPE OF WORK

A. The General Contractor shall secure the services of an independent Testing, Adjusting and Balance Agency to perform complete testing, adjusting and balancing of the Heating, Ventilating and Air Conditioning System. This section illustrates required coordination between the HVAC Contractor and the Test and Balance Contractor.

B. Responsibility of Mechanical Contractor:
1. Mechanical Contractor shall be responsible for complete system start-up prior to testing, adjusting and balancing and shall demonstrate operation of each item of mechanical equipment.
2. Motor amp draw shall be checked and adjusted to within 80% of rated amp draw during start-up procedures on all motors. Replace drive packages as necessary to achieve design conditions.
3. Set return air velocity to maximum 500 fpm at each air unit inlet during start-up procedures.
4. Attend pre-balancing conference with testing agency to demonstrate operation of system.
5. Install clean filters in all air units.
6. Verify that systems are complete and operable. Refer to Part 3, paragraph 3.2A.
7. Cooperate with Testing and Balancing Agency to provide all necessary data on the design and proper application of the system components and furnish all labor and material required to eliminate any deficiencies or malperformance. Resolve all operational deficiencies prior to submission of final TAB report.
8. Install all valves, dampers, sheaves, and miscellaneous adjustment devices in a manner that will leave them accessible and readily adjustable. The TAB Agency may be consulted if there is a questionable arrangement of a control or adjustable device.

C. Responsibility of Testing, Adjusting and Balancing Agency:
1. During construction, inspect the installation of ductwork, Building Automation System and all other components of the HVAC system. Inspection will cover that part of the work relating to proper arrangement and adequate provisions for the testing and balancing.

The inspections shall be performed periodically as the work progresses with a minimum of two inspections as follows:

a. When 60% of ductwork is installed in each building.
b. When 90% of ductwork is installed in each building.

2. Submit brief written report of each inspection to Owner, Architect, Engineer, and Contractor.
3. Provide all instruments and equipment required to accomplish necessary testing, adjusting and balancing and as required by the Engineer to verify performance. All instruments shall be in accurate calibration and shall be calibrated in ranges that will be expected.
4. Upon completion of the installation and start-up of the mechanical equipment by the Mechanical Division, the Testing, Adjusting and Balancing Agency will test, adjust and balance the system components to obtain optimum conditions in each conditioned space in the facility. TAB Agency shall work with the Automatic Temperature Controls Contractor in commissioning the operation of all motorized/balancing duty control dampers. The TAB Agency is advised that deficiencies in HVAC construction are often encountered during final TAB services and Agency should include in bid proposal an amount it deems adequate to compensate for time in identifying the deficiencies to the Mechanical Contractor and awaiting their correction.
5. Fourteen days, or earlier, prior to Owner's Final Inspection as requested by the General Contractor, the Testing and Balancing Agency shall prepare seven copies of the completed Testing and Balancing Report and submit one copy to Owner and six copies to the Architect/Engineer. The reports shall be certified accurate and complete by a principal Engineer of the Agency. Resolve all operational deficiencies prior to submission of final report.

1.3 REFERENCES

A. AABC - National Standards for Total System Balance.

B. ADC - Test Code for Grilles, Registers, and Diffusers.

C. ASHRAE 111 - Practices for Measurement, Testing, Adjusting, and Balancing of Building Heating, Ventilation, Air-conditioning, and Refrigeration Systems.

D. NEBB – Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.

E. SMACNA - HVAC Systems Testing, Adjusting, and Balancing.

1.4 SUBMITTALS

A. Submit under provisions of Section 23 05 00 – Mechanical General Conditions.

B. Submit name of adjusting and balancing agency for approval within thirty (30) days after award of Contract.

C. Field Reports: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

D. Prior to commencing work, submit report forms or outlines indicating adjusting, balancing, and equipment data required.

E. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect/Engineer and for inclusion in operating and maintenance manuals.

F. Provide reports in 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.

G. Include detailed procedures, agenda, sample report forms prior to commencing system balance.

H. Test Reports: Indicate data on AABC National Standards for Total System Balance forms, forms prepared following ASHRAE 111 or NEBB forms.

1.5 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 23 05 00 – Mechanical General Conditions.

B. Record actual locations of flow measuring stations, balancing valves and rough setting.

1.6 QUALITY ASSURANCE

Perform total system balance in accordance with AABC National Standards for Field Measurement and Instrumentation, Total System Balance or ASHRAE 111 or NEBB Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems.

1.7 QUALIFICATIONS

A. Agency: Company specializing in the testing, adjusting, and balancing of systems specified in this Section with minimum three years documented experience certified by AABC.

B. Perform Work under supervision of AABC Certified Test and Balance Engineer or NEBB Certified Testing, Balancing and Adjusting Supervisor.

1.8 PRE-BALANCING CONFERENCE

Convene one (1) week prior to commencing work of this section.

1.9 SEQUENCING

Sequence work to commence after completion of systems and schedule completion of work before Substantial Completion of Project.

1.10 DESIGN CONDITIONS

A. The HVAC systems have been designed to maintain the inside conditions indicated below when operating with the outside conditions stated. Install, test, adjust and balance the systems so that they will produce the inside conditions for design. Mechanical Contractor shall be prepared to provide a suitable test to prove that equipment is producing capacities scheduled.
   1. Inside Conditions:
      a. Summer: 75 degrees Fahrenheit dry bulb.
      b. 60% relative humidity.
      c. Winter: 70 degrees Fahrenheit dry bulb.
   2. Outside Conditions:
      a. Summer: 98.8 degrees Fahrenheit dry bulb.
      b. 78.8 degrees Fahrenheit wet bulb.
      c. Winter: 36.6 degrees Fahrenheit dry bulb.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 AGENCIES

A. PHI Service Agency, Inc.

B. Engineered Air Balance Co., Inc.

C. Testing Specialties, Inc.

D. Other Acceptable Agencies: Section 23 05 00 – Mechanical General Conditions.

3.2 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
   1. Systems are started and operating in a safe and normal condition.
   2. Temperature control systems are installed complete and operable.
   3. Proper thermal overload protection is in place for electrical equipment.
   4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
   5. Duct systems are clean of debris.
   6. Fans are rotating correctly.
   7. Volume dampers are in place and open.

8. Air coil fins are cleaned and combed.
9. Access doors are closed and duct end caps are in place.
10. Air outlets are installed and connected.
11. Duct system leakage is minimized.

B. Submit field reports. Report defects and deficiencies noted during performance of services that prevent system balance.

C. Beginning of work means acceptance of existing conditions.

3.3 PREPARATION

A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect/Engineer to facilitate spot checks during testing.

B. Drive Assemblies. In the event that the drive assembly requires a change in belts and pulleys, or requires an increase in motor horsepower, it shall be the responsibility of the HVAC Division to:
1. Determine the size of the replacement equipment.
2. Obtain and install the replacement equipment at no additional cost to Owner.

C. Manual Volume Dampers:
1. In all cases, air volumes shall be adjusted by means of manual dampers in the ductwork, not by integral dampers in the terminal outlets or inlets.
2. Duct damper positions shall be marked with permanent-ink markers or black spray paint after the final setting has been made.

3.4 INSTALLATION TOLERANCES

A. Contractor shall adjust all equipment in accordance with the capacities shown on the drawings, with permissible tolerances as follows:

Supply fans	+0 % to 10%
Exhaust Fans	0 % to-10%
Diffusers/supply grilles	-5% to+10%
Return grilles	0% to- 10%
Exhaust grilles	0% to- 10%

3.5 ADJUSTING

A. Ensure recorded data represents actual measured or observed conditions.

B. Permanently mark settings of dampers and other adjustment devices allowing settings to be restored. Set and lock memory stops.

C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

E. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.

F. Check and adjust systems approximately six months after final acceptance and submit report.

3.6 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E. Use volume control devices to regulate air quantities only to extent that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

K. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

L. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches positive static pressure near the building entries.

3.7 SCHEDULES

A. Equipment Requiring Testing, Adjusting, and Balancing:
   1. Cooling Coils.
   2. Air Cooled Condensing Units.
   3. Air Handling Units.
   4. Fans.
   5. Air Filters.
   6. Air Inlets and Outlets.

B. Report Forms:
   1. Title Page:
      a. Name of Testing, Adjusting, and Balancing Agency.
      b. Address of Testing, Adjusting, and Balancing Agency.
      c. Telephone number of Testing, Adjusting, and Balancing Agency.
      d. Project name.
      e. Project location.
      f. Project Architect.
      g. Project Engineer.
      h. Project Contractor.
      i. Report date.
   2. Summary Comments:
      a. Design versus final performance.
      b. Notable characteristics of system.
      c. Description of systems operation sequence.
      d. Summary of outdoor air and exhaust flows to indicate amount of building pressurization.
      e. Nomenclature used throughout report.
      f. Test conditions.
   3. Instrument List:
      a. Instrument.
      b. Manufacturer.
      c. Model number.
      d. Serial number.
      e. Range.
      f. Calibration date.
   4. Electric Motors:
      a. Manufacturer.
      b. Model/Frame.
      c. HP/BHP.
      d. Phase, voltage, amperage; nameplate, actual, no load.
      e. RPM.
      f. Service factor.
      g. Starter size, rating, heater elements.
      h. Sheave Make/Size/Bore.

5. V-Belt Drive:
   a. Identification/location.
   b. Required driven RPM.
   c. Driven sheave, diameter and RPM.
   d. Belt, size and quantity.
   e. Motor sheave diameter and RPM.
   f. Center to center distance, maximum, minimum, and actual.
6. Cooling Coil Data:
   a. Identification/number.
   b. Location.
   c. Service.
   d. Manufacturer.
   e. Air flow, design and actual.
   f. Entering air DB temperature, design and actual.
   g. Entering air WB temperature, design and actual.
   h. Leaving air DB temperature, design and actual.
   i. Leaving air WB temperature, design and actual.
   j. Saturated suction temperature, design and actual.
   k. Air pressure drop, design and actual.
7. Electric Resistance Heater:
   a. Manufacturer.
   b. Identification/number.
   c. Location.
   d. Model number.
   e. Design kW.
   f. Number of stages.
   g. Phase, voltage, amperage.
   h. Test voltage (each phase).
   i. Test amperage (each phase).
   j. Air flow, specified and actual.
   k. Temperature rise, specified and actual.
8. Air Moving Equipment (AHU's):
   a. Location.
   b. Manufacturer.
   c. Model number.
   d. Serial number.
   e. Arrangement/Class/Discharge.
   f. Air flow, specified and actual.
   g. Return air flow, specified and actual.
   h. Outside air flow, specified and actual.
   i. Total static pressure (total external), specified and actual.
   j. Inlet pressure.
   k. Discharge pressure.
   l. Sheave Make/Size/Bore.
   m. Number of Belts/Make/Size.
   n. Fan RPM.
9. Return Air/Outside Air Data:
   a. Identification/location.
   b. Design air flow.
   c. Actual air flow.

d. Design return air flow.
e. Actual return air flow.
f. Design outside air flow.
g. Actual outside air flow.
h. Return air temperature.
i. Outside air temperature.
j. Required mixed air temperature.
k. Actual mixed air temperature.
l. Design outside/return air ratio.
m. Actual outside/return air ratio.

10. Fan Data:
    a. Location.
    b. Manufacturer.
    c. Model number.
    d. Serial number.
    e. Air flow, specified and actual.
    f. Total static pressure (total external), specified and actual.
    g. Inlet pressure.
    h. Discharge pressure.
    i. Sheave Make/Size/Bore.
    j. Number of Belts/Make/Size.
    k. Fan RPM.
11. Duct Traverse:
    a. System zone/branch.
    b. Duct size.
    c. Area.
    d. Design velocity.
    e. Design air flow.
    f. Test velocity.
    g. Test air flow.
    h. Duct static pressure.
    i. Air temperature.
    j. Air correction factor.
12. Duct Leak Test:
    a. Description of ductwork under test.
    b. Duct design operating pressure.
    c. Duct design test static pressure.
    d. Duct capacity, air flow.
    e. Maximum allowable leakage duct capacity times leak factor.
    f. Test apparatus:
        1) Blower.
        2) Orifice, tube size.
        3) Orifice size.
        4) Calibrated.
    g. Test static pressure.
    h. Test orifice differential pressure.
    i. Leakage.
13. Air Distribution Test Sheet:
    a. Air terminal number.
    b. Room number/location.

c. Terminal type.
d. Terminal size.
e. Area factor.
f. Design velocity.
g. Design air flow.
h. Test (final) velocity.
i. Test (final) air flow.
j. Percent of design air flow.

END OF SECTION

SECTION 23 07 00
MECHANICAL INSULATION

PART 1 GENERAL

1.1 SUMMARY

Section includes ductwork insulation, duct liner, Plumbing, and HVAC equipment insulation, thermal insulation for Plumbing and HVAC piping systems including vapor retarders, jackets, and accessories.

1.2 SUBMITTALS

A. Section 23 05 00 – Mechanical General Conditions: Submittal Procedures.

B. Product Data: Submit product description, thermal characteristics, and list of materials and thickness for each service, and location.

1.3 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Applicator: Company specializing in performing Work of this section whose primary business is insulation with minimum three years documented experience.

1.4 QUALITY ASSURANCE

Materials: Flame spread/smoke developed rating of 25 / 50 or less in accordance with ASTM E84, NFPA 225, and UL 723.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.

B. Maintain temperature during and after installation for minimum period of 24 hours.

1.7 REGULATORY COMPLIANCE

Comply with latest Department of Energy regulations and ASHRAE 90.1 Standards, International Energy Conservation Code.

PART 2 PRODUCTS

2.1 GLASS FIBER, FLEXIBLE: Insulation for exterior of sheet metal ducts, backside of diffusers, storm drainage piping, and bottom side of roof drain bodies.

A. Manufacturers:
1. Johns Manville Model Microlite.
2. Knauf Model Ductwrap.
3. Owens Corning.

B. Insulation: ASTM C553 Glass Fiber Blanket Thermal Insulation for Commercial and Industrial Applications, Type II.
1. K Value: ASTM 518, 0.29 at 75 degrees F.
2. Maximum Service Temperature: ASTM C411, 250 degrees F.
3. Maximum Moisture Absorption: ASTM C1104, 0.2 percent by volume.
4. Moisture Vapor Transmission: ASTM E96, 0.02 perm.
5. Density: 0.75 or 1.0 pounds per cubic foot.
6. Minimum Installed R-Value: Refer to Part 3 Schedules.

C. Vapor Retarder Jacket:
1. Kraft paper with glass fiber yarn and bonded to aluminized film ASTM C1136, Type II.
2. Moisture vapor transmission: ASTM E96, 0.02 perm.
3. Secure with outward clinching staples and pressure sensitive tape.

D. Vapor Retarder Tape: Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

E. Installation: Maximum allowable compression is 25 percent.

2.2 ACOUSTICAL GLASS FIBER DUCT LINER, FLEXIBLE

A. Manufacturers:
1. Johns Manville.
2. Knauf.
3. Owens Corning Aeroflex Plus.
4. CertainTeed ToughGard R.

B. Insulation: ASTM C1071 Type I flexible, noncombustible blanket.
1. K Value: ASTM C177, 0.24 at 75 degrees F.
2. Maximum service temperature: 250 degrees F.
3. Density: Minimum 2.0 lb/cu ft.
4. Noise Reduction Criteria: 0.90.
5. Maximum Velocity on Coated Air Side: 6,000 ft/min.
6. Minimum Thickness and/or R-Value: Refer to Part 3 Schedules.

C. Adhesive:
   1. Manufacturers:
      a. Foster Model 81-90.
      b. Minnesota Mining Model EC104.
      c. Substitutions: Section 23 05 00 - Mechanical General Conditions.
      d. Waterproof, ASTM E162 fire-retardant type.

D. Biocide: Coat liner with EPA-registered anti-microbial agent that will not support the growth of fungus or bacteria.

E. Liner Fasteners: Galvanized steel, self-adhesive pad with press-on head.

2.3 GLASS FIBER, RIGID – For Domestic Water Piping

A. Manufacturers:
   1. Johns Manville Model Microlok.
   2. Knauf Model 850 ASJ-SSL.
   3. Owens Corning Model ASJ-SSL-II.

B. Insulation: ASTM C612; rigid, noncombustible.
   1. K Value: ASTM C177 or ASTM C518, 0.24 at 75 degrees F.
   2. Maximum Service Temperature: 850 degrees F.
   3. Maximum Moisture Absorption: 0.1 percent by volume.
   4. Minimum R-Value: Refer to Part 3 Schedules.

C. Vapor Barrier Jacket:
   1. ASTM C921, Factory applied all service jacket, white kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
   2. Moisture vapor transmission: ASTM E96, 0.02 perm inches.
   3. Secure with self-sealing longitudinal laps and butt strips, then with outward clinch expanding staples and vapor barrier finish.

D. Fittings: Material and thickness to be same as adjacent pipe. Fittings to be mitered with a minimum of 3 miters per fitting. Secure with glass fabric and mastic, and cover with PVC fitting covers. Vapor seal seams with suitable mastic.

E. Vapor Barrier Lap Adhesive:
   1. Self sealing by manufacturer.
   2. Compatible with insulation.
   3. Provide additional vapor seal by coating lap with Foster 30-35.

F. Fibrous Glass Fabric:
   1. Manufacturers:
      a. Childers #10 CHILL-GLAS.
      b. Fosters MAST-A-FAB.
   2. Cloth: Untreated; 9-oz/sq yd weight.

G. Indoor Vapor Barrier Finish:
   1. Manufacturers:
      a. Childers CP-30.
      b. Fosters 30-35.
   2. Vinyl emulsion type acrylic, compatible with insulation, white color.

H. Outdoor Vapor Barrier Finish:
   1. Manufacturers: Childers CP-21.
   2. Vinyl emulsion type acrylic, compatible with insulation, white color.

I. Insulating Cement:
   1. Manufacturers: Newell PRO-TEC KOTES Model 1MWP.
   2. ASTM C449.

J. Inserts: Provide inserts at all hangers for all pipe sizes.

2.4 CELLULAR GLASS – For Use as Insert

A. Manufacturer: Pittsburg Corning Model Foam Glass.

B. Insulation: ASTM C552, Type II – pipe and tubing insulation, Class 2 – Jacketed.
   1. K Value: ASTM C177 or ASTM C518, 0.33 at 75 degrees F.
   2. Density: 8.0 pounds per cubic foot.

2.5 ELASTOMERIC CELLULAR FOAM – For Piping or Equipment

A. Manufacturer: Armstrong Model AP Armaflex.

B. Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular form: ASTM C534; Type I, Tubular form. CFC, HCFC, HFC free.
   1. K Value: ASTM C177 or ASTM C518, 0.27 at 75 degrees F.
   2. Minimum Service Temperature: -70 degrees F.
   3. Maximum Service Temperature: +220 degrees F.
   4. Surface Burning Characteristics – Pipe Insulation: ASTM E84.
      a. 3/4 inch thickness and less: Flame Spread – 25, Smoke Developed – 50.
   5. Surface Burning Characteristics – Sheet Insulation: ASTM E84.
      a. 3/4 inch thickness and less: Flame Spread – 25, Smoke Developed – 50.
      b. 1-inch thickness: Flame Spread – 25, Smoke Developed – 50.
   6. Water Vapor Permability: ASTM E-96-90, 0.10 perm-in.
   7. Minimum R-Value: Refer to Part 3 Schedules.

C. Elastomeric Foam Adhesive:
   1. Manufacturers:
      a. Armstrong Model 520.
      b. Substitutions: Section 23 05 00 – Mechanical General Conditions.
   2. Air dried, contact adhesive, compatible with insulation.

D. Insulation Tape: Elastomeric foam tape of same material as insulation.

E. Insert Material: Compression resistant elastomeric foam material.

2.6 GLASS FIBER DUCT LINER, FLEXIBLE – Insulation for Interior of Sheet Metal Ducts.

A. Manufacturers:
1. Johns Manville Model Permacoat Linacoustic HP.
2. Knauf.
3. Owens Corning.

B. Insulation: ASTM C1071 Type I, flexible, noncombustible blanket.
1. K Value: ASTM C177, 0.25 at 75 degrees F.
2. Maximum Service Temperature: 250 degrees F.
3. Density: Minimum 1.50 lb/cu ft.
4. Noise Reduction Criteria: 0.60 at 1 inch, 0.75 at 1 1/2 inch, 0.85 at 2 inch thickness.
5. Maximum Velocity on Coated Air Side: 6,000 ft/min.
6. Minimum R-Value: Refer to Part 3 Schedules.

C. Adhesive:
1. Manufacturers:
a. Foster Model 81-90.
b. Minnesota Mining Model EC104.
c. Substitutions: Section 23 05 00 – Mechanical General Conditions.
2. Waterproof, ASTM E162 fire-retardant type.

D. Biocide: Coat liner with EPA-registered anti-microbial agent that will not support the growth of fungus or bacteria.

E. Liner Fasteners: Galvanized steel, self-adhesive pad with press-on head.

2.7 GLASS FIBER ROUND DUCT LINER

A. Manufacturers:
1. Johns Manville Model Spiracoustic Plus.
2. CertainTeed ToughGard Ultra Round.

B. Insulation: Round, preformed in cylindrical sections with acrylic polymer meeting ASTM G21 impregnated surface coat.
1. K Value: ASTM C1071, 0.23 at 75 degrees F.
2. Maximum Service Temperature: 250 degrees F.
3. Maximum Velocity on Coated Air Side: 6,000 ft/min.
4. Minimum R-Value: Refer to Part 3 Schedules.

C. Biocide: Coat liner with EPA-registered anti-microbial agent that will not support the growth of fungus or bacteria.

2.8 PLENUM WRAP

A. Manufacturer: 3M 5A.

B. Wrap non-metallic piping located in return air plenums with thickness as required by code.

2.9 JACKETS

A. PVC Plastic: Fittings in all locations:
   1. Manufacturers:
      a. Proto Corporation Model Lo Smoke.
      b. Owens Corning Model Zeston.
      c. Owens Corning Model Ceel-Co.
   2. Jacket: ASTM C921, one-piece molded type fitting covers and sheet material, off white color, factory applied coloring to identify individual services.
      a. Minimum Service Temperature: -40 degrees F.
      b. Maximum Service Temperature: 150 degrees F.
      c. Moisture Vapor Transmission: ASTM E96; 0.002 perm inches.
      d. Maximum Flame Spread: ASTM E84; 25.
      e. Maximum Smoke Developed: ASTM E84; 50.
      f. Thickness: 20 mil.
   3. Covering Adhesive Mastic:
      a. Manufacturer: Great Lakes Textile, Inc. Model Polyco.
      b. Compatible with insulation.

B. Aluminum Jacket – Refrigerant Pipe Outdoors, Domestic Water Pipe and Fittings Outdoors: ASTM B209.
   1. Thickness: 0.016 inch sheet.
   2. Finish: Smooth.
   3. Joining: Longitudinal slip joints and 2 inch laps.
   4. Fittings: 0.24 inch thick die shaped fitting covers with factory attached protective liner.
   5. Metal Jacket Bands: 1/2 inch wide; 0.015 inch thick aluminum.
   6. Color: White.

2.10 GREASE DUCT HIGH TEMPERATURE INSULATION (KITCHEN EXHUAST DUCTWORK)

Morgan Thermal Ceramics model FireMaster FastWrap XL or approved equal. Zero clearance to combustibles for kitchen grease duct application, ASTM E2336. Install per manufactures installation instructions per listing for application, external wrap.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify piping, equipment, and ductwork have been tested before applying insulation materials.

B. Verify surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

A. Install in accordance with NAIMA National Insulation Standards and Manufacturers instructions.

B. It shall be the responsibility of the contractor to ensure that an effective insulation and vapor seal is achieved on all cold surfaces which will eliminate any sweating or condensation on any cold surfaces installed by the contractor.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulate piping components such as nipples, valve stems, or other cold surfaces where condensation forms with elastomeric cellular foam tape.

E. Insulated pipes conveying fluids above ambient temperature: Insulate entire piping system including fittings, valves, unions, flanges, strainers:
1. Furnish factory-applied or field-applied standard jackets. Secure with outward clinch expanding staples and pressure sensitive adhesive system on standard factory-applied jacket and butt strips.
2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe or as specified in Section 3.3 Schedules. Finish with glass cloth and adhesive or PVC fitting covers.

F. Equipment Connections: Seal duct and piping at point of connection to equipment to maintain vapor barrier.

G. Inserts and Shields:
1. Application: Piping or Equipment 1-1/2 inches diameter or larger.
2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts. Length shall be 4 inches shorter than insert to allow for vapor retarding butt joints.
3. Insert Location: Between support shield and piping, and under finish jacket.
4. Insert Configuration: 12 inches long for pipe sizes 1 1/2 to 6 inch, 16 inches for pipe sizes 8 and 10 inch, and 22 inches for pipe sizes 12 inch and larger. Thickness and contour to match adjoining insulation; may be factory fabricated.
5. Insert Material: Cellular Glass or Calcium Silicate material. Where Elastomeric Foam material is used, provide compression resistant insulating material furnished by insulation manufacturer and suitable for planned temperature range and service.

H. Elastomeric Cellular Foam Insulation – Piping:
1. Apply adhesive at butt ends of joints and fittings.
2. Fittings shall be mitered or template-cut in accordance with manufacturer's instructions. Do not slide tubing over 90 degree elbows.

3. Inserts: Provide rigid elastomeric insulation at pipe hangers for pipe sizes 1 1/2 inch and larger to prevent compression of insulation.

I. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions. Refer to Architectural for penetrations of assemblies with fire resistance rating greater than one hour.

J. Exterior Applications: Provide vapor retarder jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor retarder cement. Cover with aluminum jacket with seams located at 3 or 9 o'clock position on side of horizontal piping with overlap facing down to shed water or on bottom side of horizontal equipment.

K. Elastomeric Insulation (Exterior Locations) – Provide aluminum jacket.

L. Domestic Cold Water – Where piping rises up form below grade and enters building, cover entrance riser with insulation and aluminum jacketing.

M. Sanitary waste piping and drains receiving HVAC condensate: Insulate drain body, p-trap, and waste piping between drain and first major sanitary branch.

N. Sanitary waste piping receiving chilled drinking water: Insulate p-trap and waste piping between drain and first major sanitary branch.

O. Factory Insulated Equipment: Do not insulate, except when indicated on Drawings, or other sections of specifications.

P. Exposed Equipment: Locate insulation and cover seams in least visible locations.

Q. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.

R. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement.

S. Insulated equipment containing fluids below ambient temperature: Insulate entire system.

T. For hot equipment containing fluids over 140 degrees F: Insulate flanges and unions with removable sections and jackets.

U. Finish insulation at supports, protrusions, and interruptions.

V. Nameplates and ASME Stamps: Bevel and seal insulation around; do not insulate over.

W. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation for easy removal and replacement without damage.

X. Insulated Ductwork Conveying Air below Ambient Temperature:
1. Provide insulation with vapor retarder jackets.
2. Finish with tape and vapor retarder jacket.
3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, expansion joints, diffuser plenums, and return plenums.
5. Seal insulation airtight where duct hanger straps penetrate insulation vapor barrier.

Y. Duct and Plenum Liner Application:
1. Adhere insulation with adhesive for 100 percent coverage.
2. Secure insulation with mechanical liner fasteners. SMACNA Standards for spacing.
3. Seal and smooth joints. Seal and coat transverse joints.
4. Seal liner surface penetrations with adhesive.
5. Duct dimensions indicated are net inside dimensions required for airflow. Increase duct size to allow for insulation thickness.

Z. Install according to manufacturer's recommended stretch out chart and to manufacturer's installation instructions where more stringent than herein.

3.3 SCHEDULES

Provide minimum thickness or R-value as follows. Increase as necessary for compliance with local code. R-values are installed values.

A. Plumbing Systems:
1. Domestic Hot Water Supply:
   a. Rigid Glass Fiber Insulation:
      1) Pipe Size Range: All sizes.
      2) Thickness: 1 inch.
2. Domestic Cold Water:
   a. Rigid Glass Fiber Insulation:
      1) All piping located outside of building envelope insulation; all piping in exterior walls (regardless of building insulation envelope); water entrance riser.
      2) Thickness: 1 inch.
3. Drains and Waste Piping receiving HVAC condensate and Chilled Drinking Water:
   a. Elastomeric Cellular Foam:
      1) Pipe Size Range: All sizes.
      2) Thickness: 3/4 inch.
   b. Flexible Glass Fiber Insulation:
      1) Pipe Size Range: All sizes.
      2) Thickness: 1 1/2 inch.

4. Roof Drain Bodies:
   a. Flexible Glass Fiber Insulation:
      1) Pipe Size Range: All sizes.
      2) Thickness: 2 inch.
5. Roof Drainage Piping Run Horizontal in Ceiling Space at Roof and Vertical Riser to Roof Drain Body:
   a. Flexible Glass Fiber Insulation:
      1) Pipe Size Range: All sizes.
      2) Thickness: 1 1/2 inch.
   b. Rigid Glass Fiber Insulation (where exposed to view in public areas).
      1) Pipe Size Range: All sizes.
      2) Thickness: 1 1/2 inch.

B. Cooling Systems:
1. Condensate Drain Lines:
   a. Elastomeric Cellular Foam Insulation:
      1) Pipe Size Range Indoors: All sizes.
         a) Thickness: 3/4 inch.

C. Exhaust Ducts (not serving kitchen equipment):
1. Rectangular Sheet Metal Ductwork: 1 inch thick Flexible Glass Fiber Duct Liner Insulation. In addition, wrap last 15 feet at connection to rooftop exhaust fans with 1 1/2 inch thick Flexible Glass Fiber Ductwork Insulation, Exterior.
2. Round Sheet Metal Ductwork: 1 1/2 inch thick Flexible Glass Fiber Ductwork Insulation, Exterior.

D. Outside Air Intake Ducts and Plenums: Flexible Glass Fiber Ductwork Insulation, Exterior Minimum Installed R=8.0.

E. Supply Ducts:
1. Rectangular Duct: Flexible Glass Fiber Ductwork Insulation, Exterior, Minimum Installed R=6.0.
2. Round Duct: Flexible Glass Fiber Ductwork Insulation, Exterior, Minimum Installed R=6.0.
3. Heaters: Flexible Glass Fiber Ductwork Insulation, Exterior, Minimum Installed R=6.0.

F. Return Ducts: Flexible Glass Fiber Ductwork Insulation, Exterior, Minimum Installed R=6.0.

G. Return Air Transfer Ducts (not serving kitchen): 1” Thick Acoustical Flexible Glass Fiber Duct Liner. External insulation is not required.

H. Backside of Diffusers: Flexible Glass Fiber Ductwork Insulation, Minimum Installed R=8.0.

I. Kitchen Hood Supply Ducts: Flexible Glass Fiber Ductwork Insulation, Exterior Minimum Installed R=6.0.

J. Grease Exhaust Ducts and Top Side of Kitchen Exhaust Hoods: 1 1/2 inch Thick High Temperature Insulation.

K. Return Air Plenums (except AHU-3): Two layers of 1" thick rigid fiberboard insulation.

END OF SECTION

SECTION 23 09 93
SEQUENCE OF OPERATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Energy Management System.

B. Constant Volume Units.

C. Exhaust Fans.

1.2 SYSTEM DESCRIPTION

A. This Section defines the manner and method by which controls function. Requirements for each type of control system operation are specified. Equipment, devices, and system components required for control systems are specified in other sections.

B. Provide all equipment, devices, and system components required for control operations described in sequence of operations and as required by Drawings.

1.3 ENERGY MANAGEMENT SYSTEM

A. HVAC System:
   1. Energy Management System (EMS) shall energize and de-energize each split system air conditioning component of HVAC system individually. Equipment shall operate on a predetermined schedule. Refer to the Equipment Schedule for Exhaust Fan control requirements.
   2. Occupied Mode: The occupied mode shall be on a totally programmable time schedule. HVAC system shall operate to maintain space thermal conditions, humidity, and ventilation rates.
   3. Unoccupied Mode: The unoccupied mode shall be on totally programmable time schedule. HVAC system shall operate to maintain space thermal conditions, humidity, and ventilation rates for purposes of set-back environment.
   4. Economizer: Provide Honeywell, Ruskin or equal economizer dampers, sensors and controls to provide enthalpy based economizer operation.

1.4 TEST AND CALIBRATION

A. After completion of installation, all controls shall be tested and calibrated to operate as required in this Specification.

B. Upon request by the Architect's Representative, demonstration of proper control system operation shall be provided prior to final job acceptance.

1.5 GENERAL REQUIREMENTS

A. Enclosures: Controllers shall be mounted in a NEMA-1 metal panel.

B. Space override buttons will be provided. Override buttons will provide a maximum of two (2) hours (adj.) of operation for that zone. Operation of the override button will enable the cooling, heating systems and air distribution systems for that zone.

C. Space temperature sensor local adjustment: Sensors shall have a temperature setpoint adjustment that can be limited in software to plus or minus 2 Deg F adjustment range from setpoint.

D. Space Thermostat and Sensor Covers: Provide lockable Lexan covers over space thermostats and temperature sensors.

E. Duct smoke detectors shall be provided, installed, and wired for fan shutdown by Division 26. A duct smoke detector is to be mounted at the supply and return air of each air handler unit, over 2,000 CFM, which will stop the unit upon a detection of smoke.

F. Dampers (All AHU's): Outside air, return air and relief air control dampers and damper actuators will be furnished and installed by the HVAC Contractor. The outside air dampers will be closed when the air handling units are off, in the unoccupied mode, or in the pre-cooling and pre-heating cycle.

G. Air Balance: The Test and Balance Contractor shall measure and verify the correct settings required for 50% of scheduled OA and 100% scheduled OA by setting OA and RA dampers.

H. Actuators: All damper actuators shall be electronic type. Only OA and relief air damper actuators need to be spring return.

I. After Hours and Unoccupied Periods: Provide night building low limits of 50 Deg F and night high limits of 85 Deg F. Humidity shall be controlled at 50% RH maximum.

J. Coordinate Occupied/Unoccupied Periods with Owner prior to construction.

1.6 CONSTANT VOLUME SINGLE ZONE AIR HANDLING UNITS (ALL AHUs)

A. The unit shall consist of a motor-operated modulating spring return outside air damper, motorized return air damper, motorized relief air damper, filter/section, direct expansion cooling coil, scroll compressor(s), electric duct heating coil, fan and safety controls.

B. Space mounted sensors shall be directly connected to AHU controller within unit. AHU controller shall be programmed for full standalone operation.

C. Optimized starting shall be provided by varying the start time each morning to get building temperature to desired setpoint by occupancy time. OA dampers shall remain closed until occupancy time.

D. Occupied Mode:
   1. Cooling and Heating: When the unit is commanded on, the fan shall run continuously, the outdoor air damper shall modulate to provide the scheduled OA CFM. The scroll compressors shall modulate to maintain space temperature cooling setpoint. In heating mode, the fan shall run constantly and EMS shall stage electric heating as required to maintain space temperature setpoint. The compressor(s) shall remain de-energized during the heating mode. AHU-1A, 1B, 3, 5: Outside air damper shall modulate to minimum set point, 50% (adj.) of scheduled outside air.
   2. AHU-1A, 1B, 3, 5: Provide a CO2 sensor mounted in the space adjacent to the temperature sensor that shall, when sensing a higher value than 800 PPM, modulate the OA and return air dampers to provide 100% of scheduled OA CFM. After the CO2 level has dropped back to less than 700 PPM, the dampers shall modulate back to provide 50% of scheduled OA CFM.

E. Night Setback Mode: When the AHU is in this mode, the outdoor air damper will remain closed even when unit is cycled on. When the night building temperature rises to 85 deg F, or the relative humidity exceeds 60% RH, the system shall start to drop temperature to 80 deg F, or drop the relative humidity to 55% RH, before stopping. When the night building temperature drops below 50 deg F, the system shall start and raise temperature to 55 deg F before stopping.

F. Economizer Cycle: Provide an enthalpy based economizer cycle. Provide an enthalpy sensor to energize the economizer cycle when the ambient dew point drops below 62 deg. F. (adj.). Return damper shall close and relief air dampers shall open. Outside air economizer damper shall modulate to maintain space temperature and humidity set points.

1.7 EXHAUST FANS

Refer to the Equipment Schedule for control requirements.

END OF SECTION

SECTION 23 23 00
REFRIGERANT AND EQUIPMENT DRAIN PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes systems, accessories, valves, pipe, and pipe-fittings for refrigerant and equipment drain piping.

B. Contractor shall provide a complete piping system in accordance with the equipment manufacturer's instructions. Where possible, the entire refrigerant piping system shall be designed by the unit manufacturer. This specification is provided for use in those situations where such a service is not offered by the equipment manufacturer.

1.2 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified, provide compatible system components and joints. Provide flanges, union, and couplings at locations requiring servicing.

B. Use unions, flanges, and couplings downstream of valves and at equipment or apparatus connections. Use non-conducting dielectric connections whenever jointing dissimilar metals. Do not use direct welded or threaded connections to valves, equipment or other apparatus.

C. Provide pipe hangers and supports in accordance with ASME B31.1 ASME B31.9.

D. Refrigerant Liquid Indicators:
1. Use line size liquid indicators in main liquid line leaving condenser.
2. When receiver is provided, install in liquid line leaving receiver.
3. Use line size on leaving side of liquid solenoid valves.

E. Refrigerant Valves:
1. Use service valves on suction and discharge of compressors.
2. Use gage taps at compressor inlet and outlet.
3. Use gage taps at hot gas bypass regulators, inlet and outlet.
4. Use check valves on compressor discharge.
5. Use check valves on condenser liquid lines on multiple condenser systems.
6. Refrigerant Charging (Packed Angle) Valve: Use in liquid line between receiver shut-off valve and expansion valve.

F. Permanent Filter-Dryers:
1. Use in low temperature systems.
2. Use in systems utilizing hermetic compressors.
3. Use filter-dryers for each solenoid valve.

G. Solenoid Valves:
   1. Use in liquid line of systems operating with single pump-out or pump-down compressor control.
   2. Use in liquid line of single or multiple evaporator systems.
   3. Use in oil bleeder lines from flooded evaporators to stop flow of oil and refrigerant into suction line when system shuts down.
   4. Use when recommended by equipment manufacturer.
   5. Use on all equipment of over five tons.
   6. Use on equipment of five tons or less when SEER is 12 or above.

H. Receivers:
   1. Use on systems 5 and larger or where recommended by equipment manufacturer, sized to accommodate pump down charge.
   2. Use on systems with long piping runs.

1.3 SUBMITTALS

A. Section 23 05 00 - Mechanical General Conditions: Submittals.

B. Shop Drawings: Submit schematic layout of refrigeration system, including equipment, critical dimensions, and sizes.

C. Product Data: Submit data on pipe materials, pipefittings, valves, and accessories. Submit manufacturers catalog information. Indicate valve data and ratings.

D. Design Data: Indicate pipe size. Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.

1.4 QUALITY ASSURANCE

Perform work in accordance with ASME B31.1, B31.9 code for installation of piping systems and ASME SEC IX for welding materials and procedures.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

D. Dehydrate and charge refrigeration components including piping and receivers, seal prior to shipment. Maintain seal until connected into system.

1.6 FIELD MEASUREMENTS

Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 EQUIPMENT DRAINS

A. Copper Tubing: ASTM B88, Type L, hard drawn.
   1. Fittings: ASME B16.18, cast brass, or ASME B16.22 solder wrought copper.
   2. Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F.
   3. Soft drawn copper is not acceptable.

2.2 REFRIGERANT PIPING

A. Copper Tubing: ASTM B280, Type ACR hard drawn.
   1. Fittings: ASME B16.22 wrought copper.
   2. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.
   3. Soft drawn copper is not acceptable.

2.3 PIPE HANGERS AND SUPPORTS

A. Refer to Section 23 05 29 – Hangers and Supports.

2.4 REFRIGERATION MOISTURE AND LIQUID INDICATORS

A. Manufacturers:
   1. Sporlan Valve Company Model See All.
   2. Alco Controls Model AMI.
   3. Mueller Brass Company Model Vuemaster.
   4. Substitutions: Section 23 05 00 – Mechanical General Conditions.

B. Indicators:
   1. Single port type, UL listed.
   2. Copper or brass body, flared or solder ends.
   3. Sight glass, color-coded paper moisture indicator with removable element cartridge and plastic cap.
   4. Maximum working pressure of 500 psig.
   5. Maximum temperature of 200 degrees F.

2.5 REFRIGERATION VALVES

A. Manufacturers:
   1. Mueller Brass Company.
   2. Henry Valve Company.
   3. Substitutions: Section 23 05 00 – Mechanical General Conditions.

B. Packed Angle Valves:
   1. Forged brass or nickel-plated forged steel, solder or flared ends.
   2. Forged brass seal caps with copper gasket, rising stem and seat with back seating, molded stem packing.

3. Maximum working pressure of 500 psig.
4. Maximum temperature of 275 degrees F.

C. Service Valves: Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or solder ends, for maximum pressure of 500 psig.

2.6 REFRIGERATION CHECK VALVES

A. Manufacturers:
1. Mueller Brass Company.
2. Henry Valve Company.
3. Substitutions: Section 23 05 00 – Mechanical General Conditions.

B. Globe Type: Cast bronze or forged brass body, forged brass cap with neoprene seal, brass guide and disc holder, phosphor-bronze or stainless steel spring, teflon seat disc; for maximum working pressure of 500 psig and maximum temperature of 300 degrees F.

C. Straight Through Type: spring, neoprene seat; for maximum working pressure of 500 psig and maximum temperature of 250 degrees F.

2.7 REFRIGERATION PRESSURE RELIEF VALVES

A. Manufacturers:
1. Mueller Brass Company.
2. Henry Valve Company.
3. Substitutions: Section 23 05 00 – Mechanical General Conditions.

B. Straight Through or Angle Type: Brass body and disc, neoprene seat, factory sealed and stamped with ASME UV and National Board Certification NB; selected to ASHRAE 15.

2.8 REFRIGERATION FILTER-DRIERS

A. Manufacturers:
1. Alco Controls Model ADKS.
2. Sporlan Valve Company Model Catch-All.
3. Substitutions: Section 23 05 00 – Mechanical General Conditions.

B. Permanent Straight Through Type: ARI 710, UL listed, steel shell with molded desiccant filter core, for maximum working pressure of 500 psig.

2.9 REFRIGERATION SOLENOID VALVES

A. Manufacturers:
1. Alco Controls.
2. Mueller Brass Company.
3. Henry Valve Company.
4. Substitutions: Section 23 05 00 – Mechanical General Conditions.

B. Valve: ARI 760, pilot operated, copper or brass body and internal parts, synthetic seat, stainless steel stem and plunger assembly, integral strainer, with flared, solder, or threaded ends; for maximum working pressure of 500 psig. Stem designed to allow manual operation in case of coil failure.

C. Coil Assembly: UL 429, UL listed, replaceable with molded electromagnetic coil, moisture and fungus proof, with surge protector and color coded lead wires, integral junction box.

2.10 REFRIGERATION EXPANSION VALVES

A. Manufacturers:
1. Sporlan Valve Company.
2. Alco Controls.
3. Substitutions: Section 23 05 00 – Mechanical General Conditions.

B. Angle or Straight Through Type: ARI 750; design suitable for refrigerant, brass body, internal or external equalizer, adjustable superheat setting, replaceable inlet strainer, with replaceable capillary tube and remote sensing bulb.

C. Selection: Evaluate refrigerant pressure drop through system to determine available pressure drop across valve. Select valve for maximum load at design operating pressure and minimum 10 degrees F. superheat. Select to avoid being undersized at full load and excessively oversized at part load.

2.11 REFRIGERATION RECEIVERS

A. Internal Diameter 6 inch and Smaller: ARI 495, UL listed, steel, brazed; 400 psig maximum pressure rating, with taps for inlet, outlet, and pressure relief valve.

B. Internal Diameter Over 6 inch: ARI 495, welded steel, tested and stamped in accordance with ASME SEC 8D; 400 psig with taps for liquid inlet and outlet valves, pressure relief valve, and magnetic liquid level indicator.

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.2 INSTALLATION

A. Install refrigerant piping in accordance with ASME B31.5 and equipment manufacturer's instructions. Confirm pipe sizing, routing, use of valves and accessories, and installation methods required by manufacturer prior to installation. Submit shop drawings of proposed layout for engineer's review.

B. Route piping parallel to building structure and maintain gradient.

C. Install piping to conserve building space, and not interfere with use of space.

D. Group piping whenever practical at common elevations.

E. Sleeve pipe passing through partitions, walls and floors.

F. Provide fire stop sealant around all piping penetrations through fire rated barriers.

G. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 23 05 48 – Vibration Isolation.

H. Slope trenches for underground piping away from building.

I. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 23 05 29 – Hangers and Supports.

J. Provide access where valves and fittings are not exposed.

K. Arrange refrigeration piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.

L. Flood refrigerant piping system with nitrogen when brazing.

M. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.

N. Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting.

O. Insulate piping and equipment; refer to Section 23 07 00 – Mechanical Insulation.

P. Follow ASHRAE 15 procedures for charging and purging of systems and for disposal of refrigerant.

Q. Provide replaceable cartridge filter-dryers, with isolation valves and bypass with valve.

R. Locate expansion valve sensing bulb immediately downstream of evaporator on suction line.

S. Provide external equalizer piping on expansion valves with refrigerant distributor connected to evaporator. Locate downstream of expansion valve sensing bulb.

T. Fully charge completed system with refrigerant after testing.

U. Locate solenoid valves at evaporator. Provide electrical connection.

V. When evaporator coils are row-split for two-stage operation, arrange piping such that leaving side coil shall be the first stage of cooling.

W. When evaporator coils are face-split for two-stage operation, arrange piping such that lower coil shall be the first stage of cooling.

3.3 FIELD QUALITY CONTROL

A. Test refrigeration system in accordance with ASME B31.5.

B. Pressure test system with dry nitrogen to 200 psig. Perform final tests at 27 inches vacuum and 200 psig using electronic leak detector. Test to no leakage. Provide reports for Engineer's review and include in operation and maintenance manuals.

C. Test refrigerant piping per split system air conditioning equipment manufacturer's requirements.

END OF SECTION

SECTION 23 31 13
DUCTS

PART 1 GENERAL

1.1 SUMMARY

Section includes metal ductwork and duct cleaning.

1.2 PERFORMANCE REQUIREMENTS

A. No variation of duct configuration or sizes other than those of equivalent or lower loss coefficient is permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE.

B. Seal ductwork in accordance with ASHRAE 90.1-1999 and International Energy Conservation Code - 2012 standards and as described herein.

1.3 SUBMITTALS

A. Section 23 05 00 – Mechanical General Conditions: Submittal Procedures.

B. Coordination Drawings: Indicate duct fittings, gages, sizes, welds, and configuration for all systems.

C. Product Data: Submit data for duct materials duct liner and duct connectors.

D. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA HVAC Air Duct Leakage Test Manual.

1.4 CLOSEOUT SUBMITTALS

Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with SMACNA - HVAC Duct Construction Standards - Metal and flexible.

B. Construct ductwork to NFPA 90A NFPA 90B and NFPA 96 standards.

C. Materials: Flame spread / smoke developed rating of 25/50 in accordance with ASTM E84, NFPA 255, UL 723.

1.6 QUALIFICATIONS

Installer: Company specializing in performing Work of this section with minimum three (3) years documented experience.

1.7 FIELD MEASUREMENTS

Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 DUCT MATERIALS

A. Galvanized Steel Ducts: ASTM A525 and ASTM A527 galvanized steel sheet, lock-forming quality, having G90 zinc coating in conformance with ASTM A90.

B. Stainless Steel Ducts: ASTM A167, Type 304.

C. Fasteners: Rivets, bolts, or sheet metal screws.

D. Hanger Rod: ASTM A36; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

E. Sealant:
1. Manufacturers / Product:
   a. Rector Seal / Air-Lock 181.
   b. Design Polymerics / DP 1020.
2. Non-hardening, Non-flammable; water-based; fiber reinforced; mildew, water and U.V. resistant; compatible with mating materials; U.L. listed 181A or 181B; liquid used alone or with tape or heavy mastic.

F. General Purpose Fire Stopping Sealant (Refer to Architectural Sections):
1. Manufacturers:
   a. 3M Model 2000.
   b. Spec Seal Model 100.
   c. Hilti.
2. Water based, nonslumping, premixed sealant with intumescent properties, rated for 3 hours per ASTM E814 and UL 1479.

2.2 DUCTWORK FABRICATION

A. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated on Drawings. Furnish duct material, gages, reinforcing, and sealing for operating pressures indicated.

B. Construct T's, bends, and elbows with minimum radius 1-1/2 times centerline duct width. Where not possible and where rectangular elbows are used, provide airfoil turning vanes. Where acoustical lining is indicated, furnish turning vanes of perforated metal with glass fiber insulation.

C. Round ductwork in secondary supply and constant volume supply, return, outside air and exhaust systems shall be constructed with grooved seam pipe

lock flat lock longitudinal seams (Refer to SMACNA 1997 Figure 3-1). Snap-lock seams are not acceptable.

D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

E. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Minimum 4 inch cemented slip joint, brazed or electric welded. Prime coat welded joints.

F. Provide standard 45-degree lateral wye takeoffs. When space does not allow 45-degree lateral wye takeoff, use 90-degree conical tee connections.

2.3 INSULATED FLEXIBLE DUCTS

A. Manufacturer:
1. Flexmaster USA, Inc. Model 1m.
2. Novaflex.
3. Buckley.
4. Peppertree Air Solutions.
5. Substitutions per Specification Section 23 05 00, sample required for prior approval.

B. UL 181, Class 1 and comply with NFPA 90A and 90B, PE inner film without adhesive supported by helical wound spring galvanized steel wire, fiberglass insulation, aluminized pigmented vapor barrier jacket having a permeance of not greater than 0.05 perms when tested in accordance with ASTM E 96, procedure A.
1. Pressure Rating: inches 10 inches wg positive and 5.0 inches wg negative.
2. Maximum Velocity: 5500 fpm.
3. Temperature Range: -20 degrees F to 250 degrees F.
4. R-value: Minimum of 6.

C. Acoustical performance, when tested by an independent laboratory in accordance with Air Diffusion Council's Flexible Air Duct Test Code FD 72-R1, Section 3.0. Sound properties shall be as follows:

Octave Band	2	3	4	5	6	7
Hz.	125	250	500	1000	2000	4000
8" diameter	5	10	22	34	22	17
12" diameter	6	27	22	28	18	11

2.4 SINGLE WALL ROUND DUCTS – SPIRAL

A. Manufacturers:
1. Spiral Pipe of Texas.
2. United McGill Uni-Seal.
3. Gowco.

B. Round spiral lock-seam duct with galvanized steel wall. Fittings to be spot welded and bonded, factory fabricated. Access doors to be pressure-relief style with insulated frame and door.

C. 90 degree elbows shall consist of not less than five (5) gores and 45 degree elbows shall consist of not less than three gores. All elbows 8" diameter and less may be die-formed longitudinally welded type with centerline radius not less than 1 1/2 times the duct diameter. Tees shall be of straight body or reducing body with 45 degree conical angle taps or "Lo Loss" tee taps. Duct fittings shall be factory fabricated. Shop or field fabricated duct fittings will not be accepted except when approved prior to fabrication.

2.5 KITCHEN EXHAUST DUCTWORK:

A. Fabricate and install in accordance with SMACNA HVAC Duct Construction Standards – Metal and Flexible, NFPA 96 and 2012 International Mechanical Code.

B. Construct of 16 gage carbon steel or 18 gage stainless steel using continuous external welded joints liquid tight.

C. Provide liquid tight access doors at all changes in direction and per International Mechanical Code.

PART 3 EXECUTION

3.1 EXAMINATION

Verify sizes of equipment connections before fabricating transitions.

3.2 INSTALLATION

A. Duct sizes shown on plans are inside clear dimensions. For lined ducts, maintain sizes inside lining.

B. Install ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, Second Edition –1995 with Addendum No.1 November 1997.

C. Field verify all measurements and dimensions prior to fabrication of any ductwork. Notify engineer where duct sizes require modifications. No additional compensation will be awarded for modifications to fit field conditions.

D. Minor changes in duct routing and dimensions to avoid structural members and other obstructions will be allowed. Major departures from duct layout will require approval of the Owner’s Representative.

E. Duct materials or prefabricated ductwork stored or installed at site shall be protected from weather, dust and moisture. Damaged duct shall be removed and replaced at the contractor's expense.

F. During construction, install temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

G. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

H. Ductwork installed above inaccessible ceiling to have operable quadrants on balancing dampers.

I. Use double nuts and lock washers on threaded rod supports.

J. Connect flexible ducts to metal ducts with stainless steel clamps or mechanically tightened draw bands. Tape inner liner and insulation to metal duct.

K. Flexible ducts shall be installed in a fully extended condition free of sags and kinks, using only the minimum length required to make the connection.

L. Set plenum doors 6 to 12 inches above floor. Arrange door swing so fan static pressure holds door in closed position.

M. Sleeve wall openings at all wall louvers installed by Mechanical Division.

N. Permanently seal openings in ducts where probes for TAB instruments are inserted.

O. All joints in spiral pipe and fittings shall be made using a sleeve type coupling, duct sealer, and duct tape. This shall consist of application of duct sealer to the male fitting, mechanically locking with a minimum of three (3) pop rivets or sheet metal screws for round duct and a minimum of six (6) pop rivets or sheet metal screws for oval duct, application of duct sealer to the outside of the joint to 2" width, and a single wrap of duct tape over the wet sealer. A minimum period of 24 hours shall elapse after installation before attempting leakage test.

P. Firestopping: Seal around all duct penetrations through fire barriers with fire stopping sealant. Provide fire dampers and smoke dampers as shown on plans.

3.3 SEALING OF DUCTWORK

A. Seal ductwork, as a minimum, in accordance with ASHRAE 90.1-1999 and IECC 2012 requirements, and as required herein. All supply, return and outside air duct shall be sealed as Class A and all exhaust duct shall be sealed as Class B, regardless of static pressure classification of system.

1. Supply, return and outside air: Seal all transverse joints, longitudinal seams, duct connections and duct wall penetrations.
2. Exhaust air: Seal all transverse joints, longitudinal seams and duct connections.
3. Pressure-sensitive tape shall not be used as the primary sealant.

3.4 LEAKAGE TESTING

Kitchen Hood Exhaust Duct: Perform leakage test in accordance with 2012 International Mechanical Code, before any external insulation is applied to ductwork.

3.5 VERIFICATION OF MINIMUM GAUGES

Contractor shall be required to cut samples of materials from installed ductwork at five locations as designated by Engineer prior to installation of insulation. Samples will be provided to Engineer for verification that gauges are in compliance with SMACNA standards and with minimum gauges as specified herein. If any sample is found not to be in compliance with contract documents, ductwork shall be replaced and an additional set of five samples shall be provided until it is determined that all ductwork is in compliance. Contractor shall patch ductwork where samples are taken. All ductwork found to be non-compliant shall be removed and replaced by Contractor at no expense to the Owner or Design Professionals.

3.6 INTERFACE WITH OTHER PRODUCTS

A. Install openings in ductwork where required to accommodate thermometers and controllers. Install pitot tube openings for testing and balancing of systems. Install pitot tube complete with metal can with spring device or screw to prevent air leakage. Where openings are provided in insulated ductwork, install insulation material inside metal ring.

B. Connect diffusers to low pressure ducts directly or with 6 feet maximum length of flexible duct held in place with strap or clamp.

C. Connect terminal units to supply ducts directly or with three foot maximum length of flexible duct. Do not use flexible duct to change direction.

3.7 CLEANING

Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient airflow, clean one half of system completely before proceeding to other half. Protect equipment with potential to be harmed by excessive dirt with temporary filters, or bypass during cleaning.

3.8 SCHEDULES

DUCTWORK MATERIAL SCHEDULE

AIR SYSTEM	MATERIAL
Supply Air –	
Round and Rectangular	Galvanized Steel
Return, General Exhaust,	Galvanized Steel
Outside Air – Round & Rectangular	
Kitchen Hood Exhaust	Stainless Steel
Kitchen Hood Supply	Galvanized Steel

DUCTWORK PRESSURE CLASS SCHEDULE

AIR SYSTEM	PRESSURE CLASS
Constant Volume - Supply	2 inch wg
Return, General Exhaust,	2 inch wg
Outside Air	
Kitchen Exhaust	2 inch wg

MINIMUM SHEET METAL GAUGES

Maximum Rectangular Duct Size Inches	U.S. Standard Gauges
Up to 12	26
13 – 30	24
31 – 48	22
49 – 54	20
55 and above	18

** Ductwork must be reinforced in accordance with pressure class and SMACNA standard requirements.

Maximum Round Duct Size Inches	U.S. Standard Gauges
Up to 14	26
15 – 26	24
27 – 36	22
37 – 50	20
51 and above	18

** Minimum duct gauges are selected for medium pressure spiral duct up to 10” inches static pressure and low pressure long seam up to 2” inches static pressure.

END OF SECTION

SECTION 23 33 01
DUCT ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

Section includes back-draft dampers, duct access doors, volume control dampers, flexible duct connections, fire dampers and duct test holes.

1.2 SUBMITTALS

A. Section 23 05 00 – Mechanical General Conditions: Submittal Procedures.

B. Manufacturer's Installation Instructions: Submit for Fire and Combination Smoke and Fire Dampers.

C. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.3 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of access doors.

B. Operation and Maintenance Data: Submit for Combination Smoke and Fire Dampers.

1.4 QUALIFICATIONS

Manufacturer: Company specializing in manufacturing products specified in this section with minimum three (3) years documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

Protect dampers from damage to operating linkages and blades.

1.6 FIELD MEASUREMENTS

Verify field measurements prior to fabrication.

1.7 WARRANTY

Furnish one (1) year manufacturer warranty for duct accessories.

1.8 EXTRA MATERIALS

Furnish two (2) of each size and type of fusible link.

PART 2 PRODUCTS

2.1 DUCT ACCESS DOORS

A. Manufacturers:
   1. Ruskin Model ADC/H series.
   2. Flexmaster.
   3. Greenheck.
   4. Philips.
   5. Safe-Air.

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated on Drawings.

C. 2 inch w.g. and less: Rigid and close fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ductwork, furnish double wall door with 1" insulation.
   1. Less Than 12 inches square, secure with sash locks.
   2. Up to 18 inches Square: Furnish two hinges and two sash locks.
   3. Up to 24 x 48 inches: Three hinges and two compression latches with outside and inside handles.
   4. Larger Sizes: Furnish additional hinge.
   5. Access panels with sheet metal screw fasteners are not acceptable.
   6. Ruskin AD series.

D. Over 2 inch w.g.: Heavy gauge galvanized steel outer frame with continuous gasket, round self-sealing low leakage inner door, quick fastening latches and cable. No raw edges shall be exposed. For insulated ductwork, furnish double wall door with1" insulation.
   1. Access panels with sheet metal screw fasteners are not acceptable.
   2. Flexmaster Inspector series.

2.2 VOLUME CONTROL DAMPERS

A. Manufacturers:
   1. Ruskin Model MD35, MDRS 25.
   2. Greenheck.
   3. Philips.
   4. Safe-Air.

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated on Drawings.

C. Multi-Blade Damper: Opposed blade pattern. Frame to be 16 gauge galvanized steel hat channel. Blades shall be single skin of 16 gauge galvanized steel with three longitudinal grooves for reinforcement. Maximum blade width of 8 inches. Linkage concealed in frame. ½ inch hex axle.

D. Round Damper: Fabricate of 20 gauge galvanized steel with 14 gauge butterfly damper blade, neoprene seal and stainless steel sleeve bearing.

E. End Bearings: Furnish end bearings. On multiple blade dampers, furnish oil-impregnated nylon or sintered bronze bearings. Furnish closed end bearings on ducts having pressure classification over 2 inches wg.

F. Quadrants:
1. Furnish locking, indicating quadrant regulators on single and multi-blade dampers.
2. On insulated ducts mount quadrant regulators on standoff mounting brackets, bases, or adapters.
3. Where rod lengths exceed 30 inches furnish regulator at both ends.
4. On dampers concealed above inaccessible ceiling, provide concealed damper regulators as manufactured by Young Regulator, Model 315, 927, 1200. In finished areas where appearance of instrument port is unacceptable, provide remote cable control as manufactured by Young Regulator, Model Bowden Cable Control.

G. Velocity and pressure rating of damper to match duct system characteristics at installed location.

2.3 LOW LEAKAGE VOLUME CONTROL DAMPERS – OUTSIDE AIR

A. Manufacturers:
1. Ruskin CD-80AF1.
2. Greenheck.
3. Phillips.
4. Safe-Air.

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated on Drawings.

C. Leakage Rate: 2.9 CFM per square foot maximum at 1” w.g.

D. Rectangular Multi Blade Damper: Opposed blade pattern. Frame and shaft to be 316 stainless steel. Blades to be airfoil type 316 stainless steel with stainless steel edge seals. Seals to be mechanically locked in blade and designed for easy replacement in field. Adhesive or clip-on seals are not acceptable. 316 stainless steel linkage concealed in frame. Square or hexagonal axles. Jamb seals to be flexible stainless steel compression type. Provide shaft seals and outward mounted ball bearings.

E. Velocity and pressure rating of damper to match duct system characteristics at installed location.

2.4 LOW LEAKAGE VOLUME CONTROL DAMPERS – RETURN AIR, RELIEF AIR

A. Manufacturers:
1. Ruskin CD-50, CDRS-25.
2. Greenheck.
3. Phillips.
4. Safe-Air.

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated on Drawings.

C. Leakage Rate: 3 CFM per square foot maximum in accordance with International Energy Conservation Code.

D. Rectangular Multi Blade Damper: Opposed blade pattern with stainless steel shafts. Frame to be 0.125 inch thick 6063-T-5 extruded aluminum hat channel with hat mounting flanges on both sides of frame. Blades to be airfoil type extruded aluminum with neoprene edge seals. Seals to be mechanically locked in blade and designed for easy replacement in field. Adhesive or clip-on seals are not acceptable. Linkage concealed in frame. Square or hexagonal axles. Jamb seals to be flexible metal (stainless steel) compression type.

E. Round Damper: Butterfly damper pattern. All other materials and construction methods to be similar to rectangular dampers.

F. End Bearings: Corrosion resistant molded synthetic sleeve type.

G. Velocity and pressure rating of damper to match duct system characteristics at installed location.

H. Provide damper position indication switch package, Ruskin SP-100, for interface with control system.

2.5 FLEXIBLE DUCT CONNECTIONS

A. Manufacturers:
1. Durodyne Model Therma Fab for indoor application, Durolon for outdoor application.
2. Vent Fab.
3. Elgen.

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated on Drawings.

C. Connector, indoors: Fabric crimped into metal edging strip.
1. Fabric: UL listed fire-retardant (500 deg. F. continuous) silicon rubber coated woven glass fiber fabric conforming to NFPA 90A, minimum density 17 oz per sq yd.
2. Net Fabric Width: Approximately 3 inches wide.
3. Metal: 3 inch wide, 24 gage galvanized steel.

D. Metal: 3 inch wide, 24 gage galvanized steel.

2.6 FIRE DAMPERS

A. Manufacturers:
1. Ruskin.
2. Greenheck.

3. Philips.
4. Safe-Air.

B. Fabricate in accordance with NFPA 90A and UL 555, and manufacturer's condition of listing. Dampers shall be dynamic type. Dampers shall be equipped for wall or floor mounting.

C. Ceiling Dampers: Galvanized steel, 22 gage frame, and 16 gage flap, two layers 0.125 inch ceramic fiber on top side with locking clip. Provide radiation blanket on air device back pan.

D. Curtain Type Dampers: Galvanized steel with interlocking blades. Furnish stainless steel closure springs and latches for closure under airflow conditions. Configure with blades out of air stream except for 1.0-inch pressure class ducts up to 12 inches in height.

E. Leakage Rating: Class 1.

F. Fire Resistance Rating: 1 1/2 or 3 hour.

G. Fusible Links: UL 33, separate at 160 degrees F with adjustable link straps for combination fire/balancing dampers.

H. Sleeve: Mount damper in integral factory fabricated steel sleeve. Duct-to-sleeve connection to be breakaway type

2.7 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Furnish extended neck fittings to clear insulation.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 23 31 13 for duct construction and pressure class.

B. Install back-draft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated on Drawings.

C. Install duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, and as indicated on Drawings. Install minimum 8 x 8 inch size for hand access, 24 x 24 inch size for shoulder access, and as indicated on Drawings. Review locations prior to fabrication.

D. Install duct test holes where indicated on Drawings and required for testing and balancing purposes.

E. Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment and supported by vibration isolators.

F. Install balancing dampers a minimum of two equivalent duct diameters from duct takeoff.

END OF SECTION

SECTION 23 34 16
FANS

PART 1 GENERAL

1.1 SCOPE

This section includes the provision and installation of fans with all supplemental equipment.

1.2 APPLICABLE PROVISIONS

A. Specification 01 45 00 – Windstorm Construction Requirements.

B. Specification 23 05 00 - Mechanical General Conditions.

1.3 PERFORMANCE

A. Provide fan type, arrangement, rotation, capacity, size, motor horsepower, and motor voltage as specified and shown on Drawings. Fan capacities and characteristics are scheduled on the Drawings.

B. Rate fans according to appropriate Air Moving and Conditioning Association, Inc. (AMCA), approved test codes and procedures. Supply fans with sound ratings below the maximums permitted by AMCA standards. All fans provided must be licensed to bear the Certified Ratings Seal.

C. Statically and dynamically balance all fans.

1.4 SUBMITTALS

A. Submit product data on all fans, including cut sheets, fan curve, sound data, performance data and accessories provided.

B. On products required to have a paint finish, submit a detailed cut-sheet of paint properties.

C. Submit sealed windstorm installation certification documentation.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Greenheck.

B. Loren Cook.

2.2 SUPPLEMENTAL EQUIPMENT

A. Motor Covers: Furnish weatherproof motor covers for installation outdoors in inclement weather. Apply the same finish as used on the fan.

B. Safety Disconnect Switch: Furnish a factory-wired, safety disconnect switch on each unit.

C. Prefabricated Roof Curbs: Furnish galvanized steel prefabricated roof curbs with built in cant strips and lined with glass fiber insulation. The minimum height is 14 inches. Slope curb base 1/4 inch per foot with level top of curb for level equipment installation. Include on each roof curb a resilient pad for equipment mounting on the top flange. Coordinate Windstorm Requirements with Structural Engineer.

2.3 DOWN-BLAST KITCHEN SUPPLY FAN

A. Unit shall be of internal frame type construction of galvanized steel. All frames and panels shall be G90 galvanized steel. All metal-to-metal surfaces exposed to the weather shall be sealed, requiring no caulking at job site. All components shall be easily accessible through removable panels. Fan shall be belt driven.

B. Centrifugal fans shall be double width, double inlet. Fan and motor shall be mounted on a common base and shall be internally isolated. All blower wheels shall be statically and dynamically balanced. Ground and polished steel fan shafts shall be mounted in permanently lubricated ball bearings. Bearings shall be selected for a minimum (L10) life in excess of 100,000 hours at maximum cataloged speeds.

C. Motors shall be energy efficient, complying with EPACT standards, for single speed ODP and TE enclosures. Motors shall be permanently lubricated, heavy duty type, matched to the fan load and furnished at the specified voltage, phase and enclosure. Drives shall be sized for a minimum of 150% of driven horsepower. Pulleys shall be cast and have machined surfaces. Units with motors of 10 HP and less shall be supplied with an adjustable drive pulley.

D. Filters shall be mounted in a straight or V-bank arrangement. Filters shall be UL Class 2, 2 inch aluminum mesh and easily removable.

E. Weatherhood shall be constructed of G90 galvanized steel and include 2 inch aluminum mesh filters at the intake.

F. Accessories: Provide the following accessories as indicated on the schedule.
   1. Provide windstorm compliant construction.
   2. Stainless steel hardware.
   3. Roof curb.
   4. Backdraft damper.
   5. Provide automatic belt tensioner.

2.4 UP-BLAST KITCHEN EXHAUST FAN

A. Fan shall be a spun aluminum, roof mounted, direct driven, up-blast centrifugal exhaust ventilator, suitable for exhausting grease laden air.

B. Fan shall be listed by Underwriters Laboratories (UL 762). Fan shall bear the AMCA certified ratings seal for sound and air performance.

C. The fan shall be of bolted and welded construction utilizing corrosion resistant fasteners. The spun aluminum structural components shall be constructed of minimum 16 gauge marine alloy aluminum, bolted to a rigid aluminum support structure. The aluminum base shall have a one piece inlet spinning and continuously welded curb cap corners for maximum leak protection. The wind-band shall have a rolled bead for added strength. A two piece top cap shall have quick release latches to provide access into the motor compartment. An external wiring compartment with integral conduit chase shall be provided into the motor compartment to facilitate wiring connections. The motor, bearings and drives shall be mounted on a minimum 14 gauge steel power assembly. These components shall be enclosed in a weather-tight compartment, separated from the exhaust airstream. A one inch thick, three pound density foil backed heat shield shall be utilized to protect the motor and drive components from excessive heat. Unit shall bear an engraved aluminum nameplate.

D. Wheel shall be centrifugal backward inclined, constructed of 100% aluminum, including a precision machined cast aluminum hub. Wheel inlet shall overlap an aerodynamic aluminum inlet cone to provide maximum performance and efficiency. Wheel shall be balanced in accordance with AMCA Standard 204-96, Balance Quality and Vibration Levels for Fans.

E. Motor shall be heavy duty type with permanently lubricated sealed ball bearings and furnished at the specified voltage, phase and enclosure.

F. Bearings shall be designed and individually tested specifically for use in air handling applications. Construction shall be heavy duty re-greasable ball type in a cast iron housing selected for a minimum L50 life in excess of 200,000 hours at maximum cataloged operating speed.

G. Belts shall be oil and heat resistant, non-static type. Drives shall be precision machined cast iron type, keyed and securely attached to the wheel and motor shafts. Drives shall be sized for 150% of the installed motor horsepower. The variable pitch motor drive must be factory set to the specified fan RPM.

H. Accessories:
   1. Vented extension.
   2. Grease trough.
   3. Hinged curb cap.
   4. External NEMA 3R Disconnect Switch – Pre-wired.
   5. Provide factory applied baked phenolic coating with UV protectant on casing, shroud and fan wheel.
   6. Provide windstorm compliant construction.

PART 3 EXECUTION

3.1 Install fans according to the manufacturer's instructions and in the locations shown on the Drawings.

3.2 Provide flexible connection at inlet and outlet for fans.

3.3 Roof mounted fans shall be installed on roof curbs provided by the fan manufacturer.

3.4 On roof mounted fans, electrical wiring and/or conduit shall not interfere with back-draft damper.

3.5 Attach curb to structure and fan to curb per local windstorm requirements.

3.6 Roof curbs shall have custom slope to existing roof. Field verify slope prior to ordering.

END OF SECTION

SECTION 23 37 13
AIR OUTLETS AND INLETS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Diffusers.

B. Registers/grilles.

C. Roof Hoods.

1.2 RELATED SECTIONS

A. Section 01 45 00 – Windstorm Construction Requirements.

B. Section 23 05 93- Testing, Adjusting and Balancing.

C. Section 23 31 13 - Ducts.

D. Section 23 33 01- Duct Accessories.

E. All divisions of Contract Documents.

1.3 REFERENCES

A. ADC 1062 - Certification, Rating and Test Manual.

B. AMCA 500 - Test Method for Louvers, Dampers and Shutters.

C. ARI 650 - Air Outlets and Inlets.

D. ASHRAE 70 - Method of Testing for Rating the Air Flow Performance of Outlets and Inlets.

E. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

F. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.

1.4 SUBMITTALS

A. Submit under provisions of Section 23 05 00 – Mechanical General Conditions.

B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

1.5 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 23 05 00 – Mechanical General Conditions.

B. Record actual locations of air outlets and inlets.

1.6 QUALITY ASSURANCE

A. Test and rate air outlet and inlet performance in accordance with ADC Equipment Test Code 1062 and ASHRAE 70.

B. Test and rate louver performance in accordance with AMCA 500.

1.7 QUALIFICATIONS

Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.1 CEILING RETURN GRILLES

A. Manufacturers:
1. Titus Model 50F.
2. Other acceptable manufacturers offering equivalent products:
a. J&J.
b. Metalaire.
c. Krueger.
d. Price.

B. Type: Eggcrate face, ½" x ½" x1/2" grid with minimum 90% free area.

C. Frame: 1 ¼" border width interlocked at four corners and staked to form a rigid frame.

D. Fabrication: Heavy extruded aluminum border with aluminum grid. Provide countersunk screw holes for surface mount application.

E. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

2.2 SQUARE CEILING DIFFUSERS

A. Manufacturers:
1. Titus Model TMS-AA.
2. Other acceptable manufacturers offering equivalent products:
a. J&J.
b. Metalaire.
c. Krueger.

B. Type: Stamped or spun, multi-core diffuser to discharge air in 360 degree pattern. Diffuser collar shall project not more than one inch above ceiling. In plaster ceilings, provide plaster ring and ceiling plaque. In suspended lay-in ceilings, provide 24" x 24" lay-in panel.

C. Fabrication: Aluminum with baked enamel white finish except as indicated on Plans.

2.3 RECTANGULAR CEILING DIFFUSERS

A. Manufacturers:
1. Titus Model TDC-AA.
2. Other acceptable manufacturers offering equivalent products:
a. J&J.
b. Metalaire.
c. Krueger.
d. Price.

B. Type: Square and rectangular, multi-louvered diffuser to discharge air in four way pattern except as indicated on Plans.

C. Frame: Surface mount, Lay-in or as indicated on Plans.

D. Fabrication: Aluminum with baked enamel white finish as indicated on Drawings.

2.4 PENTHOUSE ROOF HOODS

A. Manufacturers:
1. Loren Cook Model TRE.
2. Greenheck.
3. Acme.
4. ILG.

B. Type: Low silhouette louvered penthouse roof hood for intake application. All aluminum construction with storm proof louvers with mitered corners, built-in channel to turn back airborne moisture, removable cover with fiberglass insulation liner to prevent condensation, low pressure drop, bird screen, and roof mounting curb.

C. Mount unit on minimum 14 inch high curb base with insulation. Pitch of curb to match pitch of roof.

D. Provide tie down eyelets and coordinate Windstorm Certification Requirements with Structural Engineer.

PART 3 EXECUTION

3.1 PREPARATION

Coordinate work of this section with other affected work.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.

C. Install diffusers to ductwork with air tight connection.

D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.

E. Paint ductwork visible behind air outlets and inlets matte black.

END OF SECTION

SECTION 23 40 00
AIR CLEANING DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

Disposable, extended area panel filters and filter gages.

1.2 REFERENCES

A. ARI 850 - Commercial and Industrial Air Filter Equipment.

B. ASHRAE 52.2-1999 - Method of Testing Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter.

C. UL 900 - Test Performance of Air Filter Units.

1.3 PERFORMANCE TOLERANCES

Conform to ASHRAE 52.2-1999.

1.4 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Section 23 05 00 – Mechanical General Conditions.

B. Operation and Maintenance Data: Include instructions for operation, changing, and periodic cleaning.

1.5 EXTRA MATERIALS

Provide MERV-8 disposable panel filters during construction. Periodically inspect temporary construction filters and change out when dirty or as directed by manufacturer's recommendations whichever comes first. If, in the opinion of the Owner's Representative, the temporary construction filters require changing, then the filters shall be changed out with clean filters at no additional cost to the Owner. Provide one clean set of MERV 8 and one spare set of MERV 8 to Owner at project completion. Clean coils free of dirt and debris during and at the end of construction. Complete final cleaning before commissioning of equipment.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. CamFil/Farr Company.

B. Precisionaire.

C. American Air Filter.

2.2 DISPOSABLE, EXTENDED AREA PANEL FILTERS

A. Media: UL 900 Class 2, pleated, lofted, non-woven, reinforced cotton and synthetic fabric; supported and bonded to welded wire grid.
   1. Frame: Stainless steel or extruded aluminum.
   2. Nominal thickness: 2 inches.

B. Rating, ASHRAE 52.2: MERV 8.

2.3 FILTER GAGES

A. Manufacturers:
   1. Dwyer.
   2. Trerice.
   3. Substitutions: Specification Section 23 05 00 – Mechanical General Conditions.

B. Direct Reading Dial: 3-1/2 inch diameter diaphragm actuated dial in metal case. Furnish vent valves, black figures on white background, front calibration adjustment, range 0-2.0 inch wg, 2 percent of full scale accuracy.

C. Accessories: Static pressure tips with integral compression fittings, 1/4 inch plastic tubing, 2-way or 3-way vent valves.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install air-cleaning devices in accordance with manufacturer's instructions.

B. Prevent passage of unfiltered air around filters with felt, rubber, or neoprene gaskets.

C. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing, with clean set.

D. All AHUs: Install filter gage static pressure tips upstream and downstream of filters. Mount filter gages on outside of filter housing or filter plenum, in accessible position. Adjust and level.

3.2 SCHEDULES

All AHUs – MERV 8 filters.

END OF SECTION

SECTION 23 73 13
SPLIT SYSTEM AIR CONDITIONERS

PART 1 GENERAL

1.1 REFERENCES

A. AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.

B. AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.

C. AMCA 99 - Standards Handbook.

D. AMCA 210 - Laboratory Methods of Testing Fans for Rating Purposes.

E. AMCA 300 - Test Code for Sound Rating Air Moving Devices.

F. AMCA 301 - Method of Publishing Sound Ratings for Air Moving Devices.

G. AMCA 500 - Test Methods for Louver, Dampers, and Shutters.

H. ARI 410 – Forced-Circulation Air-Cooling and Air-Heating Coils.

I. ARI – 430 – Central-Station Air-Handling Units.

J. ARI 435 - Application of Central-Station Air-Handling Units.

K. NEMA MG1 - Motors and Generators.

L. NFPA 70 - National Electrical Code.

M. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

N. UL 900 - Test Performance of Air Filter Units.

1.2 SUBMITTALS

A. Submit under provisions of Section 23 05 00 - Mechanical General Conditions.

B. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, duct, and piping layout, and electrical characteristics and connection requirements.

C. Product Data:
   1. Provide literature that indicates dimensions, weights, capacities, ratings, fan performance, gages, and finishes of materials, and electrical characteristics and connection requirements.
   2. Provide data of filter media, filter performance data, filter assembly, and filter frames.
   3. Provide fan curves with specified operating point clearly plotted.

4. Submit sound power level data for both fan outlet and casing radiation at rated capacity.
5. Submit electrical requirements for power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.

D. Manufacturer's Installation Instructions.

E. Verify system external static pressure losses prior to selection of drive packages. Provide drive packages to achieve design capacities at field-balanced conditions.

1.3 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Section 23 05 00 - Mechanical General Conditions.

B. Maintenance Data: Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.

1.4 QUALIFICATIONS

Manufacturer: Company specializing in manufacturing the Products specified in this Section with minimum three (3) years documented experience, who issues complete catalog data on total product.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products to site.

B. Accept products on site in factory-fabricated protective containers, with factory-installed shipping skids and lifting lugs. Inspect for damage.

C. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

1.6 ENVIRONMENTAL REQUIREMENTS

Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

1.7 EXTRA MATERIALS

A. Provide one (1) set for each unit of fan belts.

B. Provide extra pulleys and sheaves for fan drive packages as necessary to achieve design capacities under final field balanced conditions.

1.8 ACCEPTABLE MANUFACTURERS

Project design is based on equipment as shown on Drawings. Other approved manufacturers are directed to verify that their equipment will “fit” within the design

envelope. Footprint of alternative equipment must not exceed the footprint of the scheduled equipment. Final approval is at the discretion of Engineer.

PART 2 PRODUCTS - AIR HANDLING UNITS

2.1 DIRECT EXPANSION INDOOR AIR HANDLING UNITS

A. Acceptable Manufacturers:
1. Carrier (Basis of Design).
2. Trane.
3. Daikin McQuay.

B. General Description:
1. Configuration: Fabricate as detailed on drawings.
2. Performance: Conform to AHRI 430. Refer to Schedules on Drawings.
3. Acoustics: Sound power levels (dB) shall not exceed the levels for the unit scheduled. The manufacturer shall provide the necessary sound treatment to meet these levels if required.

2.2 UNIT CONSTRUCTION

A. Fabricate unit with heavy gauge channel posts and panels secured with mechanical fasteners. All panels, access doors, and ship sections shall be sealed with permanently applied bulb-type gasket. Shipped loose gasketing is not allowed.

B. Panels and access doors shall be constructed as a 2-inch nominal thick; thermal break double wall assembly, injected with foam insulation with an R-value of not less than R-13.
1. The inner liner shall be constructed of G90 galvanized steel.
2. The outer panel shall be constructed of G90 galvanized steel.
3. The floor plate shall be constructed as specified for the inner liner.
4. Unit will be furnished with solid inner liners.

C. Panel deflection shall not exceed L/240 ratio at 125% of design static pressure, maximum 5 inches of positive or 6 inches of negative static pressure. Deflection shall be measured at the panel midpoint.

D. The casing leakage rate shall not exceed .5 cfm per square foot of cabinet area at 5 inches of positive static pressure or 6 inches of negative static pressure.

E. Module to module field assembly shall be accomplished with an overlapping, full perimeter internal splice joint that is sealed with bulb type gasketing on both mating modules to minimize on-site labor and meet indoor air quality standards.

F. Access doors shall be flush mounted to cabinetry, with minimum of two six inch long stainless steel piano-type hinges, latch and full size handle assembly. Access doors shall swing outward for unit sections under negative

pressure. Access doors on positive pressure sections, shall have a secondary latch to relieve pressure and prevent injury upon access.

G. A 6-inch formed G60 galvanized steel base rail shall be provided by the unit manufacturer for structural rigidity and condensate trapping. The base rail shall be constructed with 12-gauge nominal. The following calculation shall determine the required height of the base rail to allow for adequate drainage. Use the largest pressure to determine base rail height. [(Negative)(Positive) static pressure (in)] (2) + 4" = required base rail height.

H. Construct drain pans from stainless steel with cross break and double sloping pitch to drain connection. Provide drain pans under cooling coil section. Drain connection centerline shall be a minimum of 3'' above the base rail to aid in proper condensate trapping. Drain connections that protrude from the base rail are not acceptable. There must be a full 2'' thickness of insulation under drain pan.

I. Unit shall have vibration isolation.

J. AHU-1A, AHU-1B: Provide mixing box section with outside air and return air dampers.

2.3 FAN ASSEMBLIES

A. Acceptable fan assembly shall be a single width, single inlet, class II, direct-drive type plenum fan dynamically balanced as an assembly, as shown in schedule. Maximum fan RPM shall be below first critical fan speed. Fan assemblies shall be dynamically balanced by the manufacturer on all three planes. Provide access to motor and fan assembly through hinged access door.

B. Fan and motor shall be mounted internally on a steel base. Factory mount motor on slide base that can be slid out the side of the unit if removal is required. Provide access to motor, drive, and bearings through hinged access door.

2.4 BEARINGS, SHAFTS, AND DRIVES

A. Bearings: Basic load rating computed in accordance with AFBMA - ANSI Standards. The bearings shall be provided on the motor with the fan wheel mounted directly on the motor shaft, AMCA arrangement 4.

B. Shafts shall be solid, hot rolled steel, ground and polished, keyed to shaft, and protectively coated with lubricating oil. Hollow shafts are not acceptable.

C. The fan wheel shall be direct coupled to the motor shaft. The wheel width shall be determined by motor speed and fan performance characteristics.

2.5 ELECTRICAL

A. Fan motors shall be manufacturer provided and installed, Open Drip Proof, premium efficiency (meets or exceeds EPAct requirements), 1750 RPM, single speed, 460V / 60HZ / 3P. Complete electrical characteristics for each fan motor shall be as shown in schedule.

B. The air handlers shall be ETL and ETL-Canada listed by Intertek Testing Services, Inc. Units shall conform to bi-national standard ANSI/UL Standard 1995/CSA Standard C22.2 No. 236.

C. Wiring Termination: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclosed terminal lugs in terminal box sized to NFPA 70.

2.6 COOLING COIL

A. Certification: Acceptable refrigerant coils shall be certified in accordance with AHRI Standard 410 and bear the AHRI label. Coils exceeding the scope of the manufacturer's certification and/or the range of AHRI's standard rating conditions will be considered provided the manufacturer is a current member of the AHRI Forced Circulation Air-Cooling and Air-Heating Coils certification programs and that the coils have been rated in accordance with AHRI Standard 410. Manufacturer must be ISO 9002 certified.

B. Direct expansion refrigerant cooling coil shall be provided. Provide access to coil(s) for service and cleaning. Enclose coil headers and return bends fully within unit casing. Unit shall be provided with coil connections that extend a minimum of 3" beyond unit casing for ease of installation. Coil connections must be factory sealed with grommets on interior and exterior panel liners to minimize air leakage and condensation inside panel assembly. If not factory packaged, Contractor must supply all coil connection grommets and sleeves. Coils shall be removable through side and/or top panels of unit without the need to remove and disassemble the entire section from the unit.
   1. Sweat type copper suction headers shall be provided.
   2. Fins shall have a minimum thickness of 0.0075 inch aluminum plate construction. Fins shall have full drawn collars to provide a continuous surface cover over the entire tube for maximum heat transfer. Tubes shall be mechanically expanded into the fins to provide a continuous primary to secondary compression bond over the entire finned length for maximum heat transfer rates. Bare copper tubes shall not be visible between fins.
   3. Coil tubes shall be 5/8 inch OD seamless copper, 0.020 inch nominal tube wall thickness, expanded into fins on 1 1/2-inch centers, brazed at joints. Soldered U-bends shall be provided to minimize the effects of erosion and premature failure having a minimum tube wall thickness of .025 inches.
   4. Sweat type copper suction connections located at the bottom of the suction headers for gravity oil drainage. Coils shall be uniformly circuited in a counter flow manner for full face interlaced/intertwined capacity reduction. Pressure type liquid distributors used. Coils shall

be tested with 315 pounds air pressure under warm water, and suitable for 250 psig working pressure.

5. Coil casing shall be a formed channel frame of galvanized steel.

2.7 FILTERS

A. Furnish angled panel filter section with 4-inch filter racks with 2-inch pleated MERV 8 filter with microbial resistant Intersept coating. Provide side loading and removal of filters.

B. Filter media shall be UL 900 listed, Class I or Class II.

C. Filter Magnehelic gauge(s) shall be furnished and mounted by others.

D. Refer to Specification Section 23 40 00 - Air Cleaning Devices.

PART 3 PRODUCTS, DIRECT EXPANSION AIR COOLED CONDENSING UNITS

3.1 ACCEPTABLE MANUFACTURERS

A. Carrier (Basis of Design).

B. Trane.

C. Daikin McQuay.

3.2 GENERAL DESCRIPTION

A. Furnish as shown on Plans. Unit performance and electrical characteristics shall be per the job schedule.

B. Configuration: Fabricate as detailed on prints and drawings.

C. Unit shall be completely factory assembled and shipped in one piece.

D. Unit to be shipped with a nitrogen holding charge only.

E. The unit shall undergo an operational test prior to shipment. The factory test shall include a refrigeration circuit check test, a unit safety control system operations checkout, and a final unit inspection.

F. All units shall have decals and tags to indicate caution areas and aid unit service. Unit nameplates shall be fixed to the main control panel door. Electrical wiring diagrams shall be attached to the control panels. Installation, operating and maintenance bulletins and start-up forms shall be supplied with each unit.

G. Performance: All scheduled capacities and face areas are the minimum accepted value. All scheduled amps, KW, and HP are maximum accepted values that allow scheduled capacity to be met.

3.3 CABINET

A. Exterior surfaces shall be constructed of pre-painted galvanized steel for aesthetics and long term durability. Paint finish to include a base primer with a high quality, polyester resin topcoat of a neutral beige color.

B. Include final coat of Energyguard DCC Cabinet Coating (or approved equal) to provide 10,000 Hour Salt Spray Rating per ASTM B-117 standard for salt spray resistance.

C. Lifting brackets shall be provided on the unit base with lifting holes to accept cable or chain hooks.

3.4 ELECTRICAL

A. Unit wiring shall comply with NEC requirements and with all applicable UL standards. All electrical components shall be UL recognized where applicable. All wiring and electrical components provided with unit shall be number and color coded and labeled according to the electrical diagram provided for easy identification. The unit shall be provided with a factory wired weatherproof control panel. Unit shall have a power terminal block for main power connection. A terminal board shall be provided for low voltage control wiring. Branch circuit short circuit protection, 115 volt control circuit transformer and fuse, system switches, and a high temperature sensor. Each compressor and condenser fan motor shall be furnished with contactors and inherent thermal overload protection. Knockouts shall be provided in the side of the main control panels for field wiring entrance. All 115-600 volt internal and external wiring between control boxes and components shall be protected from damage by raceways or conduit.

B. Provide factory powered and wired 115V GFI outlet on unit exterior or in electrical or controls cabinet.

C. Single non-fused disconnect switch shall be provided for connecting electrical power at the unit. Disconnect switches shall be mounted internal to the control panel and operated by an externally mounted handle. Externally mounted handle is designed to prohibit opening of the control panel door without the use of a service tool.

D. Unit SCCR rating to be 10 kAIC.

E. Unit shall be provided with a 24 volt transformer and terminal strip for field supplied controls.

3.5 CONDENSING SECTION

A. Air Cooled Condenser:
   1. Units shall have at least one head pressure sensing condenser fan controlled to maintain positive head pressure.
   2. The condensing section shall be open on the sides and bottom to provide access and to allow airflow through the coils. Condenser coils

shall be multi-row and fabricated from cast aluminum micro-channel coils. Each condenser coil shall be factory leak tested with high-pressure air under water. Provide condenser coil hail guard/protection. Coils shall include a coat of primer and final coat of Energyguard DCC Green coil coating (or approved equal) to provide 10000 hour salt spray rating per ASTM B117 standard for salt spray resistance.

3. Condenser fans shall be direct drive, propeller type designed for low tip speed, vertical air discharge, and include service guards. Fan blades shall be constructed of steel and riveted to a steel center hub. Condenser fan motors shall be heavy-duty, inherently protected, three-phase, non-reversing type with permanently lubricated ball bearing and integral rain shield.

B. Scroll Compressors:
   1. Each unit shall have heavy-duty Copeland scroll compressor(s).
   2. Each compressor shall be complete with gauge ports, crankcase heater, sight-glass, anti-slug protection, motor overload protection and a time delay to prevent short cycling and simultaneous starting of compressors following a power failure.
   3. Compressors shall be isolated with resilient rubber isolators to decrease noise transmission.
   4. ACCU-2, ACCU-5: Provide two stage compressor.

C. Refrigeration Circuit:
   1. Each unit shall have two independent refrigeration circuits. Each circuit shall be complete with low pressure control, pump down switch, liquid line solenoid valve, filter drier, liquid moisture indicator/sight-glass, thermal expansion valve, liquid line charging valve with a 3/8" charging port, a manual reset high pressure safety switch. Each circuit shall be dehydrated and leak tested.
   2. Each circuit shall be dehydrated and factory charged with 410-A Refrigerant and oil. Refrigeration capacity control shall be accomplished by staging of the unit's multiple compressors. All compressor capacity control staging shall be controlled by the factory installed main unit control system.

D. Hot gas bypass capped T shall be factory installed on the discharge line of both refrigerant circuits.

E. Provide factory applied e-coat condenser coil coating or Energyguard DCC Green coil coating field applied.

3.6 CONTROLS

A. Unit shall be equipped with a 120V terminal strip controls.

B. Provide manufacturer's 7-day digital programmable touch screen thermostat with auxiliary contacts. Coordinate with economizer sequence of operation.

C. Refer to Specification 23 09 93 for Sequence of Operation requirements.

3.7 WARRANTY

A. The manufacturer shall provide 12 month parts and labor warranty. Defective parts will be repaired or replaced during the warranty period at no charge. The warranty period shall commence at start up, or 6 months after shipment, whichever occurs first.

B. The manufacturer will provide extended 48 month parts only warranty on the compressor(s).

PART 4 EXECUTION

4.1 PREPARATION

A. Coordinate work of this section with other affected work.

B. Coordinate electrical requirements with Electrical Division prior to ordering equipment.

4.2 INSTALLATION

A. Install in accordance with manufacturer's installation & maintenance instructions.

B. Install in conformance with ARI 435.

C. Install piping connection to air handling and condensing units to maintain service and maintenance clearance to coils, motors, and filters and to provide access to other mechanical and electrical equipment within mechanical rooms.

D. Provide certified factory start-up and commissioning for each air handling and condensing unit by a factory employed technician. Certified start-up and commissioning forms shall be completed and submitted to the Architect and Engineer for review within 10 working days after the startup/commissioning is performed.

4.3 ENVIRONMENTAL REQUIREMENTS

Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

4.4 EXTRA MATERIALS

Provide one (1) extra set fan belts, filters, etc for each unit.

END OF SECTION

SECTION 26 00 00
ELECTRICAL SPECIFICATIONS

1.1 GENERAL

Section 20 00 00 is a part of these Electrical Specifications for Parish Hall Package B – Our Lady of Victory Catholic Church – Diocese of Victoria, Victoria, Texas.

1.2 SCOPE

A. Work to be accomplished under these Specifications includes the furnishing of all labor, materials, and equipment required for the complete installation as described herein and as indicated on the Drawings.

B. Work is to be completed from point of service to each outlet indicated on Drawings and/or specified herein with all accessory construction as may be required to make the installation of each piece of equipment complete and ready for normal service. In general, this work consists of the following:

1. A system of power connections to the heating and air conditioning equipment as indicated on the Drawings.
2. A system of power connections to the ventilation equipment as indicated on the Drawings.
3. A system of power and control connections to kitchen equipment as indicated on the Drawings.
4. New underground service feeder from new pad mounted transformer. New underground conduit system for primary service. New transformer pad.
5. A system of conduits, junction boxes, pull boxes, outlet boxes with plates, wiring devices, panelboards, lighting fixtures, transformers, conductors, time clocks, and related items for the power and lighting system.
6. A partial system of conduits with Jetline pullcords, junction boxes, pull boxes, outlet boxes with plates, and related items for future telephone and data transmission systems.
7. A partial system of conduits, outlet boxes with plates, junction boxes, and a complete system of conductors, manual stations, control panel, signaling devices, detectors, and related items for a complete fire alarm system.
8. A partial system of conduits with pullcords, junction boxes, outlet boxes with plates, and related items for access control and security systems cabling and devices by separate contract.
9. A partial system of conduits, junction boxes, outlet boxes with plates and a complete system of conductors, control devices, control/processing equipment for a complete lighting control system for Parish Hall No. 110.

C. Installation of this work, including all materials and labor shall be first class in every respect and in exact accordance with these Specifications and accompanying Drawings. It is intended that Specifications and accompanying Drawings shall include everything requisite and necessary for proper installation of electric wiring, even though every item may not be particularly mentioned in detail.

1.3 ELECTRICAL SERVICE

A. New service utilization voltage shall be solidly grounded, 277/480 volt, 3-phase, 4-wire nominal. Power company will provide service, indicated on Drawings. Contractor shall be responsible for contacting power company for all requirements.

B. Power company construction costs associated with the provision of permanent power shall be paid to the power company by the Owner. Power company costs associated with the provision of temporary construction power shall be paid to the power company by the Contractor.

C. Contractor shall furnish all new service equipment not furnished by power company for a complete installation. Contractor shall provide transformer grounding as directed by the power company.

D. Contractor shall furnish the underground conduit system, and related items for the underground primary system.

E. Contractor shall furnish the pad as indicated on the Drawings for power company owned transformer.

F. Contractor shall furnish the secondary feeder complete as indicated on the Drawings.

G. Termination of primary conduit at both ends (transformer and point of service origin) shall be as directed by the power company. Termination of secondary conduit and wiring at the transformer shall be as directed by the power company. Termination of secondary conduit and wiring at the building main shall be as indicated on the Drawings and in these Specifications.

H. Metering will be coordinated and provided in accordance with power company requirements.

1.4 TEMPORARY POWER AND LIGHTING

A. Contractor shall provide all necessary wiring, service switches, poles, ground fault protection equipment, etc., required for temporary power and lighting during construction of the building.

B. Contractor shall provide all necessary portable/temporary cables, service switches, ground fault protection, etc. required for temporary power and lighting during construction. Temporary construction power may be derived from the existing facility distribution system without cost of use charges when such service is energized.

1.5 GROUNDING

A. The entire electrical system shall be grounded in accordance with Article 250 of the National Electrical Code, and as hereinafter specified.

B. Main service entrance ground shall be as indicated on Drawings.

C. Driven ground rods shall be provided where required and/or where indicated on the Drawings. Ground rods shall be minimum 3/4" x 10'-0" Copper-weld or equal. All ground wiring shall have adequate mechanical protection, and be exothermically welded to rods.

D. Grounding electrode and equipment conductors with a "green" colored insulated jacket shall be provided and installed in all raceways, whether non-metallic or metallic.

E. All equipment shall have an effective equipment ground in accordance with the National Electrical Code.

F. Furnish and install telephone system grounding, as directed and required by serving telephone equipment supplier and shall comply with Article 800-40 of the National Electrical Code.

G. An isolated grounding conductor shall be furnished for all isolated ground receptacles and electrical gear serving isolated ground receptacles. Isolated ground conductor shall be terminated at isolated ground device terminal at device end and at isolated ground bus at panel end. For isolated ground devices, the equipment ground shall be terminated at device outlet box at device end and at equipment ground buss at panel end.

1.6 CONDUIT AND TUBING

A. Conduit size shall be 1/2" unless otherwise indicated on the Drawings or otherwise specified.

B. Conduit installed underground or in concrete slabs shall be Schedule 40 rigid polyvinyl chloride (PVC) conduit as manufactured by Carlon or approved equal, installed in accordance with National Electrical Code, and as indicated on Drawings. All PVC conduit shall have Underwriters Laboratory, Inc. approval for direct burial underground without concrete encasement. All PVC plastic conduit must be installed in accordance with manufacturer's recommendations and in strict accordance with the applicable sections of these Specifications.

C. Conduit installed above grade in damp or wet locations shall be rigid hot-dip galvanized conduit as manufactured by Republic, Allied, Triangle, Wheatland, Western, or an approved equal, with screwed couplings and fittings. All fittings used shall be hot-dip galvanized.

D. Fittings and connections involving dissimilar metals shall not be allowed in damp or wet locations.

E. All conduit in furred ceiling spaces, interior masonry, or stud partitions and dry locations shall be galvanized thinwall (EMT) with die-cast watertight, insulated throat type compression fittings. Indentor type or set screw type connectors and

fittings will not be accepted. All conduit installed in finished spaces shall be concealed unless otherwise specifically indicated on the Drawings.

F. MC type cable is not permissible for use except as specifically permitted by Paragraph 1.6.G.2 of these Specifications. Other types of cable shall not be utilized for any purpose.

G. Flexible metal conduit shall not be used for any purpose except as hereinafter specified and as specifically indicated on the Drawings. All flexible metal conduit shall be installed in strict accordance with Articles 348 and 350 of the National Electrical Code. Non-metallic flexible conduit will not be acceptable for any purpose.
   1. Connections to mechanical and plumbing equipment shall be made with flexible metal conduit. Length of flexible conduit for this application shall not exceed 6'-0".
   2. Flexible metal conduit or MC type cable may be used above ceilings for light fixture connections. Length of flexible conduit for this application shall not exceed 6'-0".
   3. Liquid tight flexible metal conduit shall be used for connection to dry type transformers. Length of flexible conduit for this application shall not exceed 6'-0".
   4. Liquid tight flexible metal conduit with approved fittings shall be used for connection to all kitchen equipment. Length of flexible conduit for this application shall not exceed 6'-0".
   5. Where flexible conduit is used for connections to equipment in damp or wet locations, conduit shall be liquid-tight flexible metal conduit with approved fittings.

1.7 INSTALLATION AND ROUTING OF CONDUITS

A. All conduit shall be run in the straightest possible path.

B. Not more than three (3) 90 degree bends will be permitted in any one (1) conduit run and no run shall be longer than allowed by the National Electrical Code without the installation of pull boxes. There shall not be any pull boxes or junction boxes installed in inaccessible space.

C. Exposed steel conduit shall be run in straight lines, at right angles to, or parallel with walls, beams, columns, or decks, and shall be supported at maximum of 6'-0" by malleable conduit straps or suitable clamps on hangers to provide a rigid installation. PVC conduit shall not be run exposed for any application.

D. In no case shall conduit be fastened to other pipe or equipment or so installed as to prevent the ready removal of other pipes or equipment for repairs.

E. All Schedule 40 steel conduit ends are to have a minimum of five full threads. No running threads are to be used. All conduit shall be reamed after cutting and threading and before installation; runs shall be straight and true; elbows, offsets, and bends shall be uniform and symmetrical. All conduit after installation and prior to completion of project shall be capped to prevent entrance of moisture and foreign objects. Conduit shall be swabbed before installation of wire. PVC

conduit joints shall be made in accordance with manufacturer's recommendations.

F. Elbows in PVC conduit below grade shall be Schedule 80 PVC.

G. Provision shall be made for expansion and contraction of all conduit as hereinafter specified.

H. Underground PVC conduit shall not be extended above grade. PVC shall be transitioned to Schedule 40 rigid galvanized conduit at level of finished grade or slab for all exterior applications and in damp or wet locations. PVC shall be transitioned to EMT at slab level for all interior applications in dry locations.

I. All underground conduits shall have a minimum cover from top of conduit to finished grade of at least 24".

J. Provide 4" wide yellow warning tape 1’-0” above all underground conduit exterior to building lines.

K. All steel (vertical rise) conduits and fittings shall be wrapped with 3M pipe wrap. Successive winds of pipe wrap shall be overlapped at least 1". Vertical rise conduit shall be wrapped to at least 6" above finished grade or slab.

L. All grouped conduit (3 or more parallel) installed in accessible space shall be mounted to and supported by B-Line or approved equal channel strut. Strut attachment to building structure shall be made with minimum 1/4" diameter all-thread securely attached to each end of strut and to the building structure above in trapeze form. All conduit shall be neatly arranged and securely attached to strut by pipe clamps approved for this application. Strut and fitting sizes shall be as required by the number, size, and weight of conduit and conductors to be supported. Location and elevation of all conduit support structures shall be left to the discretion of the contractor who shall be charged with the responsibility of coordinating all such installations with the locations of mechanical, plumbing, architectural, and structural components. Contractor shall refer to the "General Conditions" paragraph of Section 20 00 00. All components of trapeze hangers shall be hot-dipped galvanized where such hangers are installed in damp or wet locations.

M. All conduit which is stubbed and capped below grade for future services shall be terminated with PVC T/A and female threaded rigid galvanized steel cap so that stub may be located in the future with a metal detector.

1.8 EXPANSION JOINTS

A. Provision for expansion and shifting of conduits shall be provided where conduit rises from underground or crosses a building expansion joint.

B. Conduits which are freely suspended in space and crossing a building expansion joint shall be considered as having sufficient freedom for any expansion or movement on interior of building.

C. Steel conduit connected to conduit which rises from below grade and terminating in a panelboard, cabinet, switch, or other fixed device shall have expansion fitting installed above grade.

1.9 HANGERS AND SUPPORTS

A. Contractor shall provide all hangers and supports for supporting all conduit, gutters, cabinets, and equipment of all types. All hangers and supports shall be secure and of a type appropriate in design, application, and dimensions for the particular application.

B. Concrete inserts shall be malleable iron concrete inserts. Selection of inserts shall be made with a minimum safety factor of 100% over published load ratings.

C. Perforated hanger strap and wire will not be acceptable for any supporting purpose.

1.10 PAINTING

A. Painting, in general, will be done by the General Contractor.

B. Electrical Contractor shall touch-up or refinish if so directed by the Architect any panels, cabinets, switchboards, fixtures, and other equipment furnished with a factory finish which shall become damaged in shipment or installation.

1.11 CONDUCTORS

A. All wiring and cables shall be insulated soft-drawn annealed 98% conductivity copper and shall be new. Voltage rating of wire and cable operating on voltages in excess of 50 volts shall be 600 volts A.C. For circuits operating on voltage less than 50 volts, the voltage rating shall be not less than 300 volts A.C.

B. All wire No. 12 AWG and smaller shall be solid and wire of larger size shall be stranded unless otherwise specified herein. Stranded wire will not be permitted for termination at wiring devices rated 20 amperes or less.

C. Power feeder and branch circuit wire and cables shall have insulation Type THHN unless indicated otherwise on Drawings. Standard wire size shall be No. 12 AWG copper and this size shall be used except where other sizes are indicated on the Drawings, otherwise specified herein, or otherwise required by the Code. On any run 100 feet in length or longer, No. 10 AWG copper shall be used in place of No. 12. Feeder cables shall be identified by suitable tags where they pass through pull boxes. Conductors as manufactured by Cablec, Capitol, American Insulated, Houston Wire and Cable, Southwire, and Okonite will be acceptable.

D. All wire for special systems and special conditions shall be as specified and/or as indicated on the Drawings.

1.12 WIRE PULLING LUBRICANTS

Contractor shall use Ideal “CableEase" or approved equal wire pulling lubricants for all wire installation. Soaps or other substitute material having electrical conduction properties are not acceptable.

1.13 COLOR-CODING AND TAGGING

A. All wiring furnished shall be color-coded. Conductors No. 10 AWG and smaller shall have insulation colored as follows. Conductors larger than No. 10 AWG may be black with tape manufactured for this application and colored as follows. All such conductors shall be color-code taped at all junctions and terminations.
   1. 120/208 volt, 3-phase:
      a. Phase A – Black.
      b. Phase B – Red.
      c. Phase C – Blue.
      d. Neutral – White.
   2. 277/480 volt, 3-phase:
      a. Phase A – Brown.
      b. Phase B – Orange.
      c. Phase C – Yellow.
      d. Neutral – Gray.
   3. Switched legs: Phase color with white tracer.
   4. Conductors for isolated ground branch circuits and feeders:
      a. Phase Conductors - Phase color with yellow tracer.
      b. Neutral - White with yellow tracer.
   5. Ground conductors: Green.
   6. Isolated ground conductors: Green with yellow tracer.

B. All control wiring shall be color-coded, and the same color shall be used for the same circuit throughout the system, and a different color shall be used for each separate control function.

C. Identification shall be accomplished by means of Brady "Quick-Labels" or approved equal attached permanently to all wire requiring identification in addition to the color-coding. Acceptable manufacturers: Thomas and Betts, Ideal.

1.14 INSULATION OF SPLICES AND CABLE TERMINATION

All connections for conductors No. 8 and larger must be made by means of a compression type connector UL listed and specifically approved for the purpose for which it is used. Wire No. 10 and smaller may connected with wire nuts in lieu of compression connections, if desired by contractor.

1.15 OUTLET AND SWITCH BOXES

A. All boxes shall be galvanized and shall be set with covers flush and square with the finished surface.

B. Boxes set in plaster finished walls or concrete shall be #52151, 4" square boxes 1 1/2" deep or deeper with 1/2" or 3/4" raised plaster rings as required by device shall be used.

C. Boxes set in concrete block, structural tile, brick, plywood, formica, or other field installed surfaces shall be square cut masonry boxes, and shall have standard square type corners.

D. All boxes shall be securely attached to the structural members by suitable metal bar hangers.

E. Junction boxes and pull boxes shall be furnished where indicated on the Drawings, or as required by the National Electrical Code. Boxes shall be of code gauge galvanized steel, and shall have removable screw cover. Flush boxes shall be used on all walls and ceilings where conduits are concealed. Where conduits are exposed, surface type boxes shall be used.

F. Any boxes not installed in a workmanlike manner shall be removed by contractor, wall repaired, and box reset.

G. Boxes and conduit fittings for outdoor work shall be cast metal, watertight, and have gasketed coverplates.

1.16 LOCATION OF OUTLET BOXES

A. Contractor shall determine from the complete dimensioned Architectural Drawings, the electrical details and Drawings, and from other contractors, the locations of all pieces of equipment prior to locating any outlet boxes or devices.

B. All outlet boxes, devices, etc., shall be located so as to be clear of equipment, permanent fixtures, building trim, etc. If the exact location of any equipment is not clearly defined, the contractor shall request direction from the Architect prior to locating the facilities for the equipment.

C. Locations of services for equipment connections shall be determined accurately from certified shop drawings on equipment to be served, or from actual measurements of the equipment itself.

D. All wall outlets for equipment on panel walls shall be located symmetrically with the pattern established by the panels. Determine exact location for all boxes from the Architect before installation.

E. All ceiling outlets shall be located in close cooperation with the air conditioning and the acoustical ceiling, so that outlets will be symmetrical with ceiling pattern established by the air conditioning diffusers and by the acoustical ceiling tile. Final lighting fixture locations shall be as approved by the Architect. All corridor fixtures shall be mounted in a straight line.

F. Outlet boxes for receptacles and light switches shall be mounted with long axis of the box vertical unless otherwise indicated on the Drawings.

G. Size and location outlet boxes for special and/or recessed equipment shall be obtained from the equipment manufacturer supplying the equipment.

1.17 HEIGHT OF OUTLETS

A. The following table shall act as a general guide to aid the contractor in locating elevations of outlet boxes where such elevations are not specifically indicated on the Drawings.

OUTLET	LOCATION	ABOVE FLOOR TO TOP OF BOX
Convenience Receptacles	Walls in general	18" or as directed by Architect
Convenience Receptacles	Walls at work benches	42" or as directed by Architect
Switches	Walls	48" on strike of door

B. The exact location of all outlets shall be as approved by the Architect who reserves the right to change the position of any outlet by a distance of five feet in any direction, from the position indicated on the Drawings before work is roughed-in, without extra charge. Outlet heights are indicated in these Specifications as a guide. Regardless of heights indicated, the contractor is ultimately responsible for confirming that all final outlet locations are in compliance with the requirements of Texas Architectural Barriers Act and Title III Provisions of the Americans with Disabilities Act.

1.18 WIRING DEVICES

Wiring devices, or approved equal, as scheduled and/or indicated on the Drawings shall be furnished and installed. All receptacles shall be grounding type, and shall be polarized in accordance with the latest standards of the National Electrical Code.

1.19 COVERPLATES

A. All coverplates for switches, receptacles and other wiring devices, except as hereinafter specified, shall be satin finish, Type 302 stainless steel, smooth with matching screws.

B. All coverplates shall have matching screws.

C. Coverplates for exterior wiring devices and wiring devices in damp or wet locations shall be rain-tight while-in-use type die cast covers.

1.20 DISCONNECT SWITCHES

A. All disconnect switches shall be Square D Type GD for 240 volt use and Square D Type HD, or approved equal, for 480 volt use, quick-make quick-break type safety switches with cover interlocked door.

B. All switches on exterior of building and in damp or wet locations shall be in NEMA 3R enclosures.

C. All motors and fixed equipment connections shall have disconnects as required by the National Electrical Code.

D. All disconnect switches shall have the load served by the switch identified by 1/8" thick white thermoplastic with black (3/4" stroke) sunken letter nameplate screwed or riveted to outside cover of the switch.

E. Disconnect switches as manufactured by Cutler-Hammer will be acceptable.

1.21 LIGHTING FIXTURES

A. Lighting fixtures as hereinafter specified and as indicated on the Drawings shall be furnished and installed by the contractor. Installation details and scheduled information indicated on the Drawings describe the requirements of each fixture type and shall apply where applicable.

B. Recessed fixtures shall be installed in complete compliance with all applicable codes and with the requirements these Specifications. Outlet boxes shall have bar hangers.

C. Supports of adequate capacity and rigidity shall be provided for all fixtures. Also, refer to "Hanger and Supports" Section of these Specifications.

D. All fixtures in areas with suspended acoustical tile ceilings shall be supported to structural system independent of the acoustical tile suspension system. All fixtures in other type ceilings shall have fixture support independent of the ceiling provided where required by weight or size of the fixtures.

E. Alignment of lighting fixtures and ceiling diffusers shall be carefully coordinated on the job. Where ceiling diffusers are located on ceilings, locate light fixtures symmetrical with diffusers.

F. Contractor shall test all fixtures containing emergency battery packs and submit a report indicating the time and date emergency fixtures were tested, the name of personnel who performed the test, and the results of the test. The test report shall be included within the Operation and Maintenance manual submittal.

G. Lamps shall be furnished for all fixtures. Fluorescent lamps shall be 41K color as manufactured by G.E., Phillips, and Sylvania.

H. Sockets for all fixtures shall be heavy duty type make of high density material with all current carrying parts made of heavy copper. All sockets shall be white in color on all exposed lamp fixtures.

I. All fluorescent ballasts and LED drivers shall be equivalent in all respects to devices included within scheduled fixtures. Values of voltage rating, input power, output frequency, power factor, total harmonic distortion, and life expectancy

shall be equal to the values of ballasts selected by scheduled information on the Drawings.

J. Locations and elevations indicated on the Drawings for exterior wall pack fixtures are intended to serve as a general guide. Contractor shall verify the exact location and elevation of all such fixtures with the Architect prior to the installation of rough-in for same.

K. All directional distribution type fixtures with narrow x long type distribution shall be mounted such that long axis of distribution is parallel with long axis of area to be illuminated.

L. Where wall mounted emergency fixtures (other than exit signage) are located in exposed structure areas, such fixtures shall be located 1'-0" below lowest structural roof members. Where such fixtures are located in areas with ceilings, fixture elevation shall be 6" below ceilings. Where such fixtures are located in spaces which have multi-level ceiling heights and/or structure, all fixtures shall be located at the same elevation (6" below) which shall be established by the lowest ceiling or structural member elevation.

M. Data furnished on lighting fixtures shall indicate specifically by manufacturer their compliance with the above special requirements where applicable. If this information is not provided, the data cannot be accepted.

N. Substitutions may be offered by the contractor, provided the substitute fixture is equal to the specified fixture in performance, physical appearance, mechanical features and efficiency.

1.22 CONTROL EQUIPMENT, WIRING, AND CONNECTIONS

A. Furnish and install all conduit, wire, control connections, and associated control provisions in connection with the installation of the kitchen hood supply / exhaust fans. Control wiring for same shall be installed complete in all respects to achieve control required by kitchen hood and fire suppression system vendor furnished wiring diagrams and electrical drawings. All control wiring shall be installed in conduit.

B. The HVAC contractor shall furnish and install complete automatic temperature control system.

C. Electrical Contractor shall provide power wiring and terminations as required for control equipment furnished and installed by the HVAC Contractor.

1.23 WIRING OF MOTORS

All motors specified under other divisions of the Specifications will be furnished by the respective contractor. Electrical shall provide all power wiring and connections to same. See the Control Equipment, Wiring, and Connections Section of these Specifications.

1.24 CIRCUITING

Contractor shall connect all wires so as to provide the arrangement of circuits indicated on the Drawings.

1.25 IDENTIFICATION AND LABELING OF DISTRIBUTION GEAR

A. Contractor shall furnish white thermoplastic (1/8" thick) with black sunken letters (3/4" stroke) for all panelboards, distribution panelboards, transformers, and disconnect switches. Labels shall be permanently attached to service side of all such gear.

B. Identification and labeling of individual branch circuit devices shall be provided as hereinafter specified.

1.26 SPACES AND SPARES

A. Where spaces are indicated on the Drawings for panelboards and distribution panelboards, all such spaces shall be completely equipped provisions such that future installation of overcurrent devices requires no accessory apparatus.

B. Where spares are indicated on the Drawings for panelboards and distribution panelboards, all such spares shall be completely equipped and line side connected devices, such that future use of same requires load side connection only.

1.27 PANELBOARDS AND CABINETS

A. Contractor shall furnish all panelboards as indicated on Drawings, and riser diagrams. Panelboards shall be of dead-front type and shall be complete with lockable door and trim. Each door shall be equipped with spring latch and tumbler-lock. All locks shall be keyed alike and two keys shall be provided to the Owner for each lock. Cabinets shall be 20" wide code gauge steel and boxes shall be galvanized. Each panel shall have main lugs and/or main breakers as indicated. Branch circuits shall be equipped with bolt-on type automatic circuit breakers for each circuit. Panelboards shall bear the Underwriter's Laboratories, Inc., seal of approval. All panelboards shall have tin plated copper bussing with capacity as indicated. Lugs shall be UL listed to accept solid or stranded copper and aluminum conductors.

B. Panels shall be Square D Type NQ with QOB circuit breakers or equal for 120/208 volt use, and Type NF with EDB circuit breakers or equal for 277/480 volt use. Multi-pole breakers shall be one handle common trip.

C. Panelboards shall have 100% rated copper neutral bus and copper ground bar.

D. Branch circuits as indicated on the Drawings shall be connected to the corresponding breaker number of the panels insofar as possible. Each circuit bearing load shall be identified on a typewritten directory card inside the door of each panel. Spare circuit breakers and spaces shall be hand written in pencil on directory card.

E. Series rating for circuit breakers in panels is not acceptable, all circuit breakers shall be fully rated.

F. Panelboards by Cutler-Hammer will be acceptable.

1.28 DISTRIBUTION PANELS

A. Furnish and install distribution panelboards as indicated on the Drawings. Panelboards shall be dead-front, safety type equipped with thermal magnetic, molded case circuit breakers of frame and trip ratings as indicated on the Drawings.

B. Panelboard bus structure and main lugs or main breaker shall have current ratings as indicated on the Drawings. Such ratings shall be established by heat rise tests with maximum hot spot temperature on any connector or bus bar not to exceed 50 degree C. rise above ambient. Heat rise tests shall be conducted in accordance with Underwriter's Laboratories Standards. Buss structure in all distribution panels shall be tin plated copper.

C. Circuit breakers shall be equipped with individually insulated, braced and protected connectors. Front faces of all circuit breakers shall be flush with each other. Each individual circuit breaker shall have circuit number identified by means of white thermoplastic labels (1/8" thick) with black sunken letter (3/4" stroke) permanently attached to panel cover near each respective circuit breaker, spare, and space. This circuit number shall correspond to number on typewritten directory card attached to inside panel door which indicates respective loads. Tripped indication shall be clearly indicated by the breaker handle taking a position between ON and OFF.

D. Each panelboard, as a complete unit, shall have a rating equal to or greater than the integrated equipment rating indicated on the Drawings. Such rating shall be established by test with the circuit breakers mounted on the panelboard. Short circuit tests on the circuit breaker and on the panelboard structure shall be made simultaneously by connecting the fault to each panelboard breaker with the panelboard connected to its rated voltage source.

E. Cabinets shall be surface mounted and shall be equipped with spring latch and tumbler-lock. All locks shall be keyed alike and two keys shall be provided to the Owner for each lock. Doors over 48" long shall be equipped with three-point latch and vault lock. Endwalls shall be removable. Fronts shall be of code gauge full-finished steel with rust-inhibiting primer and baked gray enamel finish. Weatherproof cabinets shall be furnished, as indicated on Drawings.

F. Panelboard interior assembly shall be dead-front. Main lugs shall be front barriered. The end of the bus structure opposite the mains shall be barriered.

G. Panelboards shall be listed by Underwriter's Laboratories and shall bear the UL label. Panelboards shall be suitable for use as service equipment where indicated on the Drawings. Distribution panelboards shall be Square D I-LINE, or approved equal.

H. Panelboards shall have 100% rated copper neutral buss and copper ground bar.

I. Series rating for circuit breakers in distribution panels is not acceptable, all circuit breakers shall be fully rated.

J. Panelboards by Cutler-Hammer will be acceptable.

1.29 GENERAL PURPOSE DRY TYPE TRANSFORMERS

A. The general purpose dry type distribution transformers indicated on the Drawings shall be 3-phase, 60 cycle, air insulated and air cooled, 2-winding, dry type, of the capacity as indicated. Primary shall be 480 volts with standard taps and secondary shall be 120/208Y volts. 480 volt supply is obtained from a grounded wye source and the secondary of the transformer shall be connected to the source neutral.

B. Transformers 25 KVA and above shall be 150 degrees C. temperature rise above 40 degree C. ambient. All insulating materials to be in accordance with NEMA ST20-1972 Standards for a 220 degrees C. UL component recognized insulation system.

C. Transformer coils shall be of the continuous wound construction and shall be impregnated with non-hygroscopic, thermo-setting varnish.

D. Enclosure shall be designed for floor mounting except where wall mounting is indicated on the Drawings. Provide rain shields for all transformers to be installed outdoors. All wiring to the transformer shall be completely enclosed in conduit and the transformer case. Transformers shall meet the latest requirements of the ASA and NEMA, and shall have inorganic silicone insulation for operation of 150 degrees C. temperature rise.

E. Transformer noise levels shall be within standards published by NEMA ST20 and ANSI C89.2. Each transformer conduit connection shall have a 24" section of flexible "Sealtite" conduit adjacent to the transformer to help prevent vibration transmission to the building.

F. Isolation Mounts: Transformers shall be mounted on Korfund Type VPS elasto-rib damper isolator bases having integral load distribution top plate.

G. Transformers shall be Square D, Cutler-Hammer or approved equal.

H. The grounding conductor for interior transformers shall utilize a CGB connector where such conductor enters the transformer housing. The grounding conductor for exterior transformers shall be protected from the transformer housing to the grounding electrode.

1.30 CONNECTIONS TO EQUIPMENT SPECIFIED ELSEWHERE OR BY THE OWNER

A. Certain equipment will be furnished by the Owner or other contractors on the job which will require electrical services and connections by the Electrical.

Contractor shall refer to the "Disconnects", and "Control Equipment, Wiring, and Connections", "Wiring of Motors", and the "Location of Outlet Boxes" Sections of these Specifications.

B. HVAC equipment such as air handling units, condensing units, electric duct heaters, ventilation equipment, etc., shall be furnished and installed by the HVAC Contractor. Electrical services indicated on the Drawings are based on the requirements of specified HVAC equipment. Attention is directed that in the event the HVAC Contractor furnishes equipment other than specified, changes may be required to accommodate the electrical load and quantity of electrical connections for such furnished equipment. Electrical Contractor must coordinate changes resulting from differences between the specified and furnished HVAC equipment and advise the HVAC Contractor of any additional costs. HVAC Contractor shall be responsible for paying all costs involved as a result of the changes.

C. Electric water cooler units, water heaters, circulation pumps, and other equipment will be furnished and installed by the Plumbing Contractor. Electrical shall provide electrical connections in accordance with vendor furnished drawings.

D. Certain equipment will be furnished by Owner and under other sections of the Specifications. Equipment connections will be based on vendor furnished drawings, or actual requirements of equipment.

E. Kitchen equipment will be furnished and installed under other divisions of the Specifications. Electrical shall rough-in and make final connections to all kitchen equipment. Rough-in and final connections shall be based upon vendor furnished drawings.

1.31 TELEPHONE AND DATA TRANSMISSION ROUGH-IN SYSTEM

A. Provide a partial telephone and data transmission rough-in system with a Jetline pullcord in each conduit. Minimum conduit size shall be 1".

B. Conduit shall extend from each rough-in outlet box to point above accessible ceiling, or as indicated.

C. Provide a blank coverplate for all rough-in outlet boxes.

D. Furnish and install service raceways as required by Telephone Company.

1.32 ACCESSORY CONSTRUCTION APPARATUS

It is the intention that these Specifications shall provide a complete installation, except as herein specifically excepted. All accessory construction and apparatus necessary or advantageous in the operation or testing of the work shall be included. Omission of specific references to any part of the work necessary for such complete installation shall not be interpreted as relieving the contractor from furnishing such work.

1.33 TESTS/DEMONSTRATION

A. The entire system upon completion shall be "Meggered" for faults in accordance with methods approved by I.E.E.E. and National Electrical Code if so directed by the Engineer.

B. A demonstration shall be performed in the presence of a representative of the Architect. Equipment installed and/or connected by the contractor shall be put through their normal operating paces and all such equipment shall be required to operate to the satisfaction of the Architect on completion of the job.

1.34 INSTRUCTIONS

Contractor shall provide for instructing an employee or employees of the Owner in the operation and maintenance of the systems. Duplicate sets of manufacturer's certified drawings, specifications, operating instructions, maintenance manuals, and maintenance instructions on all equipment furnished by contractor shall be furnished to the Owner.

1.35 WORKMANSHIP AND INSTALLATION

A. Contractor shall have his choice as to the location of conduits, pull boxes, etc., except for locations set by dimensions on Drawings, provided his choices do not interfere with piping, fixtures, and equipment installed by other contractors working on the same project, and do not interfere with the characteristic features of the building. In cases of such interference, the Architect will determine the locations of the interfering items.

B. Contractor shall make such progress in his work that he will not delay the work of other trades unduly.

C. Contractor shall provide service to all using connections.

D. Cutting of any structural member, regardless of material, shall be kept at a minimum. Contractor shall pay for repairing damage to such members.

E. All electrical fixtures and fittings of all types shall be properly supported to construction.

END OF SECTION

SECTION 28 31 00
FIRE DETECTION AND ALARM SYSTEM

1.1 SCOPE

A. Sections 20 00 00 and 26 00 00 are a part of these Specifications for Parish Hall Package B – Our Lady of Victory Catholic Church – Diocese of Victoria, Victoria, Texas. All applicable conditions and requirements of Sections 20 00 00 and 26 00 00 and conditions of the contract shall apply to this Section of the Specifications.

B. Contractor shall design, furnish, and install a complete microprocessor based 24 VDC, closed circuit, electrically supervised, intelligent fire alarm system. The system shall include, but not be limited to, all control equipment, power supplies, signal initiating and signaling devices, conduit, wire, fittings, and all other accessories required to provide a complete and operable system.

C. The system shall operate as a non-coded, continuous sounding system which shall sound alarm devices until manually silenced.

1.2 GENERAL

A. Equipment furnished under this Specification shall be equal in all respects to the equipment of the specified manufacturer.

B. All systems proposed, must be proven to meet all the requirements of the Contract Documents. All prospective bidders proposing substitute systems must comply with prior approval requirements as mandated by Architectural Sections of these Specifications.

1.3 SUBMITTALS

A. Shop Drawings:
   1. Fire alarm equipment and devices indicated on the Drawings and specified herein are intended to illustrate the general extent and character of system requirements. Specific wiring between equipment/devices has not been indicated. Location and quantity of devices indicated are intended to be used as general guide. It is the Contractor's responsibility to submit for approval the complete designed system configuration and layout indicating all devices, wiring, conduit, and locations along with other required information as specified herein for the system proposed for installation.
   2. Prepare and submit all shop drawings and calculations as required by the authorities having jurisdiction.
   3. Factory data sheets on each piece of equipment to be used and so marked as to model, dimensions, size, voltage, and configuration.
   4. Fire alarm shop drawing submittal shall include, but not be limited to, floor plan drawings locating and naming each device. Control panel configuration including wiring and interconnection schematics as required by Texas Insurance Code, Article 5.432.

5. Calculations for the power supplies and batteries.
6. All submittal data shall be in bound form with Contractor's name, project name, and State Fire Alarm License Number of Installer.

B. Operation and Maintenance Manuals. Provide the following:
1. As built shop drawings showing all installed devices, schematic cable routing, and the as programmed address of each addressable device.
2. Complete operating and maintenance instruction manuals.
3. Point-to-point wiring as installed for reference and instructional use.
4. Complete Bill of Material for reference and recommended spare parts.
5. Programming matrix defining all input/output functions and zoning.

1.4 APPLICABLE CODES AND APPROVALS

A. Specifications and standards listed below form a part of this Specification. The system shall fully comply with the latest adopted version of the following standards:
1. No. 70 National Electrical Code (NEC).
2. No. 72 National Fire Alarm Code.
3. No. 101 Life Safety Code.
4. Local and State Building Codes.
5. International Building Code including International Fire Code and all standards/codes adopted by reference.
6. All requirements of the Authority Having Jurisdiction (AHJ).
7. Americans with Disabilities Act.
8. Texas Accessibility Standards.

1.5 EQUIPMENT AND MATERIAL, GENERAL

A. All equipment and components shall be new and the manufacturer's current model. Materials, appliances, equipment, and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protected premises protective signaling (fire alarm) system.

B. To establish the type, quality, and features of system required, the equipment specified is that of the Notifier Company. Equivalent equipment may be considered if equal in all respects.

C. If other equipment is submitted for approval, the Contractor shall state what, if any, specific points of system operation differ from the specified points of the system operation. This differentiation report must reference every paragraph of this Specification.

1.6 WIRING AND CONDUIT

A. All wiring shall be in accordance with listed codes, ordinances, regulations, and Article 760 of NEC. All wiring sizes shall conform to recommendations of the equipment manufacturer, and as indicated on the approved engineered shop drawings.

B. All wire shall be UL listed.

C. All wiring for intelligent/addressable circuits shall be of the twisted/shielded type to guard against outside RF and EMF interference and induced noise.

D. All wiring shall be run in a supervised fashion per NFPA requirements such that any wiring disarrangement will initiate the appropriate trouble signals via the main control panel per NFPA and UL requirements. Intelligent loops may be T-tapped/branch wired due to inherent dynamic supervision.

E. Wiring splices shall be kept to a minimum with required splices to be made in designated terminal boxes or at field device junction boxes. Transposing or color code changes of wiring will not be permitted. End-of-line supervisory devices shall be installed with the last device on the respective circuit. Said device shall be appropriately marked designating it as the terminating device on the respective circuit.

F. Conduit shall be furnished and installed by the Electrical Contractor. Refer to Section 26 00 00 for conduit requirements.

G. Wiring installed in inaccessible space and wiring exposed to view in unfinished spaces such as mechanical rooms and storage areas shall be installed in conduit. Wiring installed above accessible ceilings may be run exposed. All wiring run exposed in plenum space shall be plenum rated cable. All wiring run exposed where cable tray or J-hooks are available, shall be installed in cable tray or J-hooks. All wiring run exposed where cable tray or J-hooks are not available shall be neatly bundled and supported to the building structure at minimum 6'-0" intervals.

H. Where conduit is run from wall mounted outlet boxes to above ceilings and conduit is open-ended above ceilings in non-plenum space, all such raceway openings shall be sealed airtight after fire alarm cable is installed. All sealing material shall be pliable and readily removable. Where conduit openings are located in plenum space, sealing is not required.

I. Conduit fill shall not exceed 40% of interior cross sectional area where three or more cables are contained within a single conduit.

J. Cable must be separated from any open conductors of power, or Class 1 circuits, and shall not be placed in any conduit, junction box, or raceway containing these conductors, per N.E.C. Article 760-29.

1.7 WARRANTY

A. Fire alarm system shall be free from defects in workmanship and materials, under normal use and service, for a period of one (1) year from the date of acceptance. Any equipment indicated to be defective shall be repaired, replaced, or adjusted during normal working hours at no cost to the Owner.

B. Fire alarm equipment installer shall provide to the Owner a completed State Fire Alarm Certification Certificate for the project upon completion and warrant, in

writing, that he has filed the appropriate copies with the authorities having jurisdiction.

1.8 PROJECT CLOSE OUT

The vendor shall provide the following documentation and service:

A. Shop Drawings: Five (5) sets. These drawings shall include the manufacturer's specification sheets, including all the component parts.

B. State Certification.

C. Installing Contractor shall provide a complete written report on the functional test of the entire system. Test and report shall verify the function of each device in the system, operation of all auxiliary control functions, and the proper operation of the main fire alarm control panel.

1.9 BASIC SYSTEM FUNCTIONAL OPERATION

When a fire alarm condition is detected and reported by one of the system initiating devices or appliances, the following functions shall immediately occur:

A. The system alarm LED shall flash.

B. Activate a local piezo electric signal in the control panel.

C. Activate the 80 character LCD display at the fire alarm control panel and remote annunciator**s** which shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.

D. History storage equipment shall log the information associated each new fire alarm control panel condition, along with time and date of occurrence.

E. Activate all system output programs assigned via control by event equations to be activated by the particular point in alarm shall be executed, and the associated system outputs (alarm indicating appliances and/or relays) shall be activated.

F. Shut down all air handling units as required by applicable codes.

G. Activate auto-dialer (digital alarm communicator/transmitter) to place call (pre-programmed message) to the proper emergency agency.

1.10 PRODUCTS

A. Main Fire Alarm Control Panel: Fire alarm control panel shall be a Notifier Model NFS-320 and shall contain a microprocessor based central processing unit (CPU). The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent detectors, addressable modules, and other system controlled devices.

B. System Capacity and General Operation:
   1. Control panel shall provide, or be capable of expansion to 318 intelligent/addressable.
   2. Fire alarm control panel shall include a full featured operator interface control and annunciation panel that shall include a backlit liquid crystal display, individual, color coded system status LEDs, and an alphanumeric keypad for the field programming and control of the fire alarm system.
   3. All programming or editing of the existing program in the system shall be achieved without special equipment and without interrupting the alarm monitoring functions of the fire alarm control panel.

C. Central Microprocessor:
   1. Microprocessor unit shall communicate with monitor and control all external interfaces with the control panel. It shall include EPROM for system program storage; non-volatile memory for building-specific program storage; and a "watch dog" timer circuit to detect and report microprocessor failure.
   2. Microprocessor unit shall contain and execute all control-by-event programs for specific action to be taken if an alarm condition is detected by the system. Such control-by-event programs shall be held in non-volatile programmable memory and shall not be lost even if system primary and secondary power failure occurs.
   3. Microprocessor unit shall also provide a real-time clock for time annotation of system displays, printer, and history file. Time-of-day and date shall not be lost if system primary and secondary power supplies fail. The real-time clock may also be used to control non-fire functions at programmed time-of-day, day-of-week, and day-of-year.

D. SLC Loop Interface: SLC interface shall provide power to, and communicate with, all of the intelligent/addressable detectors and addressable modules over a single pair of wires. SLC loop shall be capable of operation as NFPA Style 4, Style 6, or Style 7.

E. Serial Interfaces:
   1. An EIA-232 interface between the fire alarm control panel and UL listed electronic data processing (EDP) peripherals shall be provided.
   2. EIA-485 port for the serial connection of the optional annunciators and remote LCD displays shall be provided.
   3. Optional plug-in modules shall be provided for NFPA 72 transmitters as well as a digital alarm communicator/transmitter.

F. Specific System Operations:
   1. Smoke Detector Sensitivity Adjust: Means shall be provided for adjusting the sensitivity of any or all analog intelligent smoke detectors in the system from the system keypad. Sensitivity range shall be within the allowed UL window.
   2. Alarm Verification: Each of the intelligent/addressable smoke detectors in the system may be independently selected and enabled to be an alarm verified detector.

3. Alarm verification delay shall be programmable from 5 to 50 seconds and each detector shall be able to be selected for verification. Fire alarm control panel shall keep a count of the number of times that each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.
4. Point Disable: Any device in the system may be enabled or disabled through the system keypad.
5. Point Read: The system shall be able to display or print the following point status diagnostic functions: device status; device type; custom device label; present analog reading (in percent-per-foot obscuration); analog detector alarm level, in percent-per-foot; device zone assignments; and all program parameters.
6. System Status Reports: Upon command from an operator of the system, a status report will be generated and printed, listing all system status.
7. System History Recording and Reporting: The fire alarm control panel shall contain a history buffer that will be capable of storing up to 650 system alarms trouble operator actions. Each of these activations will be stored and time and date stamped with the actual time of the activation. The contents of the history buffer may be manually reviewed, one event at a time.
8. Although the foreground history buffer may be cleared for user convenience, a background, non-erasable buffer shall be maintained which provides the last 650 system events.
9. The history buffer shall use non-volatile memory. Systems that use volatile memory for history storage are not acceptable.
10. Automatic Detector Maintenance Alert: The fire alarm control panel shall automatically interrogate each intelligent smoke detector and shall analyze the detector responses over a period of time.
11. If any intelligent smoke detector in the system responds with a reading that is below or above normal limits, then the system will enter the trouble mode, and the particular detector will be annunciated on the system display.
12. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools, or computer expertise to perform.
13. Pre-alarm Function: The system shall provide two levels of pre-alarm warning to give advance notice of a possible fire situation. Both pre-alarm levels shall be fully adjustable in the field. The first level shall give an audible indication at the panel. The second level shall give an audible indication and may also activate control relays.
14. Software Zones: Fire alarm control panel shall provide 99 software zones. All addressable devices may be field programmed to be grouped into these zones for control activation and annunciation purposes.
15. Fire alarm control panel shall include as integral device, Notifier Digital Auto-Dialer (digital alarm communicator/transmitter). Factory installation shall include everything requisite to proper communication/transmission of emergency message. Fire Alarm Contractor shall furnish and install Cat. 5, 4-pair UTP cable from auto-dialer to Telephone Company telephone board. Cable shall be tagged "Digital Alarm Communicator/Transmitter." Final termination at the telephone board

shall be by the Communications Contractor. All required programming of auto-dialer shall be by the Fire Alarm Contractor.

G. Batteries:
1. Shall be 12 volt, gell-cell type.
2. Battery shall have sufficient capacity to power the fire alarm system for not less than 24 hours plus 5 minutes of alarm upon a normal AC power failure.

H. Field Devices:
1. Intelligent Duct Detector: Notifier DNR with an FSP-851R series duct mounted "intelligent" photoelectric smoke detectors shall be provided. Detectors shall operate on the same principles and exhibit the same basic characteristics as area type "intelligent" smoke sensors. Duct detectors shall be furnished complete with enclosure, visual annunciator, relay, and sampling tube.
2. Smoke Detectors: Fire alarm area coverage type smoke detectors shall be Notifier FSP-851. Detectors shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.
3. Heat Detector: Fire alarm thermal detector shall be Notifier FST-851. Thermal detectors shall be intelligent addressable devices rated at 135 degrees F. (58 degrees C.) and have a rate-of-rise element rated at 15 degrees F. (9.4 degrees C.) per minute. It shall connect via two wires to the fire alarm control panel signaling line circuit.
4. Addressable Manual Stations: Notifier Model NBG-12LX manual stations shall be provided. Addressable manual station shall connect with two wires to one of the intelligent control panel loops. Manual station shall, on command from the control panel, send data to the panel representing the state of the manual switch. Provide Stopper II with horn on all stations.
5. Monitor Module: Notifier Model FMM-1 addressable monitor modules shall be provided to interface to contact alarm devices. Monitor module shall be used to connect a supervised zone of conventional initiating devices (any N.O. dry contact device, including 4-wire smoke detectors) to an intelligent SLC loop. Monitor module shall mount in a 4" square electrical box. Each zone shall be wired Class B.
6. Control Module: Notifier Model FCM-1 control/relay modules shall be provided, to provide audible alarm interface and/or relay control interface. Control module shall be used to connect a supervised zone of conventional indicating devices (any 24 volt polarized audio/visual indicating appliance) to an intelligent loop. Control module will mount in a standard 4" electrical box. The zone shall be wired Class B. Control module may be optionally wired as dry contact (Form C) relay.
7. Isolator Module: Isolator modules shall be Notifier Model ISO-X, provided to automatically isolate wire-to-wire short circuits on an SLC loop. Isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC loop. If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the SLC loop. When the short circuit condition is

corrected, the isolator module shall automatically reconnect the isolated section of the SLC loop.

8. Visual alarm shall be adjustable candela System Sensor SR (c). Provide wall mounted and ceiling mounted type devices as indicated on the Drawings. Rating of candela output shall be as required by each respective room size for compliance with Americans with Disability Act intensity requirements.
9. Horn/Strobe: Fire alarm horn/strobe shall be adjustable candela, adjustable sound level System Sensor P2R (c). Provide wall mounted and ceiling mounted type devices as indicated on the Drawings. Strobe shall have candela output rating as required by each respective room size for compliance with the Americans With Disabilities Act intensity requirements. Decibel output of each device shall be as required by audibility requirements of applicable codes. All field wiring connections shall be made via terminal connections.
10. Auxiliary HVAC Relays: Notifier Model FRM-1 addressable relays shall be provided for control and interface of all air handling units so indicated on the Drawings.
11. Remote Power Supplies: Field charging power supplies shall be Notifier FCPS-24. Power supplies shall be furnished and installed as required to serve notification appliance loads. All power supplies shall be installed at readily accessible locations. Power supplies shall not be installed in visible locations within occupiable spaces. Power connections to remote power supplies shall be provided by the Electrical Contractor as required. Coordination of power services for remote power supplies shall be coordinated with the Electrical Contractor by the Fire Alarm Contractor prior to submittal of proposal.
12. Sprinkler and Standpipe Valve Supervisory Switches: Valve supervisory switches are existing. Connection of same to the fire alarm system shall be by the Fire Alarm Contractor. Jobsite survey existing conditions prior to submittal of proposal.
13. Waterflow Indicator: Waterflow switches are existing. Connection of same to the fire alarm system shall be provided by the Fire Alarm Contractor. Jobsite survey existing conditions prior to submittal of proposal.
14. Remote annunciator – FDU-80 80 character LCD display.

1.11 FINAL INSPECTION

At the final inspection, a factory trained representative of the manufacturer of the major equipment shall demonstrate that the system functions properly in every respect. The system shall be run through simulated detection and alarm sequences in the presence of a representative of the Architect. The system must be demonstrated to the satisfaction of the Architect prior to final acceptance. Time and date of demonstration shall be that which is approved by the Architect.

1.12 INSTRUCTION

A. A minimum of six (6) hours of instructional sessions shall be provided to personnel of the Owner to educate the Owner in proper operation, maintenance, and programming of the system. Hands-on demonstrations of the operation of

all system components and the entire system including program changes and functions shall be provided. Time and date of instructional sessions shall be selected by the Owner.

B. Contractor and/or the systems manufacturer's representatives shall provide a typewritten "Sequence of Operation."

END OF SECTION