SECTION 15010 - GENERAL CONDITIONS FOR MECHANICAL WORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. General: Bidding and/or negotiations requirements, general conditions of the contract, supplementary conditions, pertinent portions of sections in Division 1 of the project specifications and the drawings shall apply to the work of this section.

1. Examine such documents together with addenda issued and bid the work in accordance with same.

2. Certain paragraphs included in this section are supplementary to similar paragraphs in above named documents. They are not intended to supersede those paragraphs. Should any conflict exist, the matter shall be referred to the architect for clarification.

1.02 SPECIAL CONDITIONS

A. These special conditions shall supplement the conditions of the contract.

B. Codes, ordinances, rules and regulations:

1. Plumbing: Perform all work under this contract in strict accordance with the plumbing code of the State of Louisiana or other authority having jurisdiction, the International Plumbing Code, all other pertinent codes and ordinances, and per NEC, AGA and NMPC requirements, where applicable.

2. H.V.A.C.: Perform all work in accordance with the mechanical code of the State of Louisiana or other authority having jurisdiction, and all other codes, ordinances, rules and regulations in effect at the site.

3. All work done under this contract shall comply with all state and local codes and with the requirements of the utility companies whose services may be used. All modifications required by these codes shall be made by the contractor without additional charges. Any conflict between these documents and the governing codes shall be immediately brought to the attention of the engineer of record. Where code requirements are less than those shown on the plans or in the

specifications, the plans and specifications shall be followed. Where applicable, N.F.P.A. requirements shall be met.

4. The contractor shall comply with all applicable provisions of the William-Steiger Occupational Safety and Health Act (O.S.H.A.).

5. The publications listed below form a part of this specification to the extent referenced and are referred to in the text by the basic designation only:

   Air-Conditioning and Refrigeration Institute Standards (ARI)

   American National Standards Institute, Inc. Standards (ASNI)

   American Society for Testing and Materials Publications (ASTM)

   American Society of Mechanical Engineers Code (ASME)

   Factory Mutual Underwriters (FM)

   National Fire Protection Association Standard (1986) (NFPA)

   Sheet Metal and Air Conditioning Contractors' National Association Inc. (SMACNA)

   Underwriters Laboratories, Inc. (UL)

   International Plumbing and Mechanical Code

   NEBB - National Environmental Balancing Bureau

1.03 WORK BY OTHERS

A. The general contractor will include in his work the leaving of openings in the building roof, floors and walls for supply, return and exhaust air ducts and piping otherwise noted or specified herein. It is this contractor's responsibility to see that all openings are left in floors and partitions for the proper operation of the system and that all openings are in the correct location and are dimensioned to receive the specified piping, duct or equipment.

B. All power wiring and final power connections to the system shall be provided under Division 16. Motor controls, pilot lights, push buttons, and equipment starters shall be provided under Division 15 either separately or as part of the packaged system.

C. Concrete for equipment foundations, housekeeping pads, inertia bases, pipe supports, etc. shall be by the general contractor. This contractor shall provide dimensioned drawings and anchor bolts for general contractors use.

1.04 FEES, PERMITS AND INSPECTIONS

A. Secure all permits, licenses and inspections as required by all authorities having jurisdiction. Comply with all laws, ordinances, rules, regulations and contract requirements bearing on the work; notify proper authorities as required to permit timely inspection of the work. Keep all inspection tags of approval or disapproval and provide proof of inspection and approval by authorities having jurisdiction, if requested by architect.

B. Pay all fees required.

1.05 SOIL CONDITIONS

A. This specification and the drawings in no way imply the condition of the soil to be encountered. Where excavating is required, each contractor agrees that he has informed himself regarding conditions affecting his work, labor, and materials required without recourse to any representation as to soil conditions that may appear or seem to be implied in any portion of the contract documents.

1.06 EXPLANATION AND PRECEDENCE OF DRAWINGS

A. For purposes of clearness and legibility, drawings are essentially diagrammatic and, although size and location of equipment are to be drawn to scale whenever possible, the contractor shall make use of all data in all of the contract documents and shall verify this information at building site.

B. The drawings indicate required size and points of termination of pipes and ducts, and suggest proper routes of pipe to conform to structure, avoid obstructions and preserve clearances. However, it is not intended that drawings indicate all necessary offsets, and it shall be the work of this section to install piping in such a manner as to conform to structure, avoid obstructions, preserve headroom and keep openings and passageways clear without further instruction or cost to the owner.

C. It is intended that all apparatus be located symmetrically with architectural elements, and shall be installed at exact height and locations as shown on the architectural drawings. Any equipment or piping installed in locations different than shown or requiring physical space other than shown or specified shall be done at responsibility of the contractor and shall be subject to approval of the architect.

D. The contractor shall fully inform himself regarding any and all peculiarities and limitations of spaces available for the installation of all work and materials furnished and installed under the contract. He shall exercise due and particular caution to determine that all parts of his work are made quickly and easily accessible. The contractor shall be guided by the architectural details and conditions existing at the job, correlating this work with that of the other trades, and report to the architect any discrepancies or interference's that are discovered. Failure to report such discrepancies and interference's shall result in the correcting of these errors or omissions by the contractor at his own expense. All work installed under this division which deviates from the drawings and specifications without prior approval of the architect, shall be altered by the contractor at his own expense to comply with the drawings and specifications as directed.

E. The contractor shall be solely responsible for taking his own measurements and installing his work to suit conditions encountered. In all cases, lines requiring a stated grade or slope for their proper operation shall have precedence. Any piping, ductwork, or equipment which interferes with the proper routing of lines requiring a stated grade or slope, shall be removed and re-routed as necessary to avoid conflict.

F. It is the intention of the drawings that the plumbing contractor be responsible for the final connection of all sanitary sewer, domestic water, natural gas and other services to the building. In those cases where the drawings require the plumbing services to be stubbed outside the building and capped for future connection, the plumbing contractor shall be responsible for all final connections to the site services to insure a complete and workable system.

1.07 INSPECTION OF SITE

A. Prior to submitting a bid or commencing work, the contractor shall visit the construction site and shall thoroughly acquaint himself with existing conditions and shall include in his bid the cost of any existing conditions which may affect his work.

B. Every effort shall be made by the contractor to protect existing utilities. Any damage to the existing utilities shall be repaired at the contractor's expense.

1.08 WORKMANSHIP, MATERIALS AND EQUIPMENT

A. All work shall be performed in a workmanlike manner and shall present a neat and mechanical appearance when completed. All materials shall be of type, quality and minimum rating prescribed herein or indicated on the plans.

1.09 CUTTING AND PATCHING

A. This contractor shall perform all cutting required for the introduction and placement of this work. The general contractor shall perform all patching work. Cutting and patching required as a result of the omission of an opening in construction shall be done by the contractor at his own expense.

B. All patching shall be done by the general contractor. This contractor shall coordinate patching with general contractor to insure finished condition matches adjacent area.

1.10 PROTECTION OF WORK

A. This contractor shall protect his work at all times from damage by freezing, breakage, dirt, foreign materials, etc., and shall replace all work so damaged. The contractor shall use every precaution to protect the work of others, and he will be held responsible for all damage to other work caused by his work or through the neglect of his workmen.

B. This contractor shall receive, unload and protect all equipment to be provided under this division by the contractor. Additionally, the contractor shall receive, unload and protect all equipment to be provided by others but connected by this contractor.

1.11 NOISE LEVEL

A. The equipment selected and specified is done so in order to establish design NC levels. Any equipment provided other than specified shall not exceed the design NC levels.

1.12 CERTIFICATION

A. Prior to completion and final acceptance of the mechanical systems, furnish to the architect certification that all mechanical systems have been tested and that the installation and performance of these systems conform to the requirements of the plans and specifications.

PART 2 - PRODUCTS

2.01 PRODUCTS AND MATERIALS:

A. The equipment to be furnished under this contract shall be the standard product of the manufacturer. Where two or more units of the same equipment are required, they shall be products of a single manufacturer.

B. All materials shall be new and of the best quality.

2.02 MANUFACTURER'S QUALIFICATIONS

A. Manufacturer's names are mentioned in these specifications to establish a standard of quality and construction, and except where a choice among several listed manufacturers is given, it is not intended to exclude the product of any reputable manufacturer regularly engaged in the commercial production of specific equipment, provided all essential requirements of the specifications relative to material, capacity and performance and appearance are met and are approved by engineer and architect.

2.03 SUBSTITUTION OF MATERIALS AND EQUIPMENT

A. For products specified herein, bids shall be based on products named in project manual and on plans, or on items designated as an "approved equal". A product not named in project manual or on plans will only be acceptable when such product meets all other requirements of project specifications, including specifications of originally specified products' manufacturer as of date of contract documents and request has been made for product substitution.

The first manufacturer listed in these specifications and the manufacturer and catalog number listed in the equipment schedules was used for design, layout, performance, physical size, space and structural requirements, electrical requirements and general appearance. Any equipment selected from the approved alternate list of manufacturers must be compatible with the facility and meet all requirements of the contract documents. Any changes required due to the alternate selected equipment being different from the design basis equipment, shall be the responsibility of the mechanical contractor and he shall pay for any increased costs as a result of these changes.

B. Requests for approval of a product as equal will not be considered unless sufficient data for evaluation is received seven (7) days prior to the bid opening date. *Any product not listed in the contract documents as an approved equal or listed by addendum as prior approved, will be rejected during the submittal process. Manufacturers of products having no prior approval should not offer the product during the bid process.*

2.04 MOTORS

A. Unless specifically noted otherwise in other sections of this specification, all motors and motor controllers shall meet the requirements specified in this section. All motors shall be built in accordance with the current applicable IEEE, ASA, and NEMA standards.

B. Each motor shall be suitable for the service of the driven unit, rated with 1.15 minimum service factor. The motor temperature rise shall not exceed 40 degrees C. for drip proof motors, 50 degrees C. for splash proof motors, and 55 degrees C. for totally enclosed or explosion proof motors. The motor shall be capable of operating continuously at such temperature rises, and shall be capable of withstanding momentary overloads of 25 percent without injurious overheating. The motors provided shall operate at no greater than the motor nameplate horsepower at nameplate service factor.

C. Each item of motor driven equipment shall be furnished compete with the motors and drives as required to perform the specific function for which it is intended, scheduled, and specified.

D. Motors shall be ball bearing type selected for quiet operation and shall be manufactured for general purpose duty unless otherwise indicated. Each bearing shall be accessible for lubrication and designed for the load imposed by the V-belt drive or the driven apparatus. Direct drive motors shall be designed for the specific application with all necessary thrust bearings, shaft capacities, etc. or as specified in equipment sections. This additional guarantee shall include parts only.

2.05 ACCESS DOORS.

A. Furnish and install access doors at teach point required to provide access to concealed valves, cleanouts, fire dampers and other devices requiring operation, adjustment, or maintenance. Access doors shall be 24 gauge galvanized steel, with mounting straps, concealed hinges and locks, designed for the doors to open 180 degrees. Doors installed inn insulated ductwork shall be insulated.

B. Access doors installed in fire walls or partitions shall be U.L. labeled to maintain the fire rating of the wall or partition.

2.06 FLAME SPREAD AND SMOKE DEVELOPED PROPERTIES OF MATERIALS

A. Materials and adhesives used throughout the mechanical and electrical systems for insulation, and jackets or coverings of any kind, or for piping or conduit system components, shall have a flamespread rating not over 25 without evidence of continued combustion and with a smoke developed rating not higher than 50. If such materials are to e applied with adhesives, they shall be tested as applied with such adhesives, or the adhesives used shall have a flamespread rating not over 25 and a smoke developed rating not higher than 50. (Note: Materials need not meet these requirements where they are entirely located outside of a building and do not penetrate a wall or roof, and do not create an exposure hazard).

B. Piping, duct, insulation, wiring and other materials placed in air conditioning plenums or plenum chambers or other spaces used for environmental air handling purposes shall have a flamespread of not more than 25 and a smoke developed rating of not more than 50. All such materials shall meet the requirements of noncombustible building materials as defined by the Standard Building Code or the material shall be enclosed within a fire resistant assembly meeting the noncombustible requirements.

C. "Flame-Spread Rating" and "Smoke Developed Rating" shall be as determined by the "Method of Test of Surface Burning Characteristics of Building Materials, NFPA No. ASTM E84, Underwirters' Laboratories, Inc., "Building Materials List" under the heading "Hazard Classification (Fire)".

2.07 EQUIPMENT FURNISHED BY OWNER

A. The contractor shall unload, uncrate, assemble, and connect any and all equipment shown on the drawings or called out in the specifications to be furnished by the owner for installation by the contractor.

B. The contractor shall take full charge of such equipment from the time the items are delivered to the job, set in place, connected, tested, adjusted, and placed into operation.

2.08 HAZARDOUS MATERIALS

A. No products shall be used that contain any known hazardous or carcinogenic materials. Products with asbestos or radioactive content shall not be used.

B. Handling of any hazardous material is not covered in this Specification Division 15. Any requirements for such are beyond the scope of this contract and shall be done only by those persons contracted to do so.

PART 3 - EXECUTION

3.01 MEASUREMENTS

A. All contractors shall verify measurements and shall be held responsible for the correctness of same. No extra charges or compensation will be allowed for differences between actual dimensions and those indicated by the plans. Any differences found shall be submitted to the architect for consideration before proceeding with the work.

B. Where equipment is being furnished by another contractor or the owner and connected by this contractor, this contractor shall request of the architect an approved drawing showing exact dimension of required locations of services and shall install required facilities to the exact requirements of the approved drawing furnished.

C. Contractor shall notify the architect of his requirements for confirmed locations a reasonable time in advance of construction to permit obtaining such data.

D. Failure of contractor to perform as described shall make him responsible for costs or changes required to conform to the requirements.

3.02 PIPING AND DUCTWORK ROUTING

A. All piping and ductwork in finished areas, except where noted to the contrary, shall be installed in chases, furred spaces, above ceilings, etc. In all cases, pipes and ducts shall be installed as high as possible. Runs of piping shall be grouped whenever it is feasible to do so.

B. Piping, equipment, or ductwork shall not be installed in electrical equipment rooms or elevator machine rooms except as serving only those rooms. Outside of electrical equipment rooms, do not run piping or ductwork, or locate equipment, with respect to switchboards, panelboards, power panels, motor control centers, or dry type transformers.

1. Within 36" in front (and rear if free standing) of equipment: or

2. A space 30" wide shall be maintained in front of each piece of equipment. Clearances apply vertically from floor to structure.

Provide access to equipment and apparatus requiring operation, service or maintenance within the life of the system, including, but not limited to, motors, valves, filters, dampers, shock absorbers, etc. Equipment located above lay-in type ceilings is considered accessible.

3.03 EXCAVATION, TRENCHING AND BACKFILLING

A. Perform all excavation, trenching and backfilling for work under Division 15. During excavation, material for backfilling shall be piled back from the banks of thee trench to avoid overloading and to prevent slides and cave-ins. All excavated materials not to be used for backfilling shall be removed and disposed of. Grading shall be done to prevent surface water from flowing into trenches and other excavations and any water accumulating therein shall be removed by pumping. Al excavations shall be made by open cut.

B. Bottom of trench shall be uniformly graded to provide firm support and even bearing surface fro pipe.

C. Pipe shall be laid on firm soil, laid in straight lines and on uniform grades. Provide bell holes so that barrels of pipe rest evenly on bottom of trench along entire length of pipe.

D. Pipe shall be inspected and tested prior to backfilling. No roots, rocks or foreign materials of any description shall be used in backfilling the trenches. Trench shall be hand filled to a minimum of twelve (12) inches above the top of the pipe with clean earth and tamped to 95 percent compaction after first layer using the test method of compaction specified in Division 1.

3.04 DEWATERING

A. Contractor shall perform all work necessary to lower and control the ground water levels and hydrostatic pressures to permit all excavation, backfill, and construction to be performed in the dry. The control of all surface water shall be considered as part of the work under this system. Dewatering may be required where trenches are deep.

B. Dewatering system shall be of sufficient size and capacity necessary to lower and maintain the ground water table to an elevation at least one foot below th bottom of pipe trench and to allow all materials to be excavated in a reasonable dry condition. The materials to be removed shall be sufficiently dry to permit excavation to the grades shown to stabilize the excavation slopes where sheeting is not required. The dewatering system shall be operated continuously until backfill work has been completed.

C. Reduce the hydrostatic head below any excavation to the extent that the water level in the construction area is a minimum of one foot below the prevailing excavation surface.

D. Maintain stability of the sides and bottom of the excavation.

E. The control of all surface and sub-surface water are part of the dewatering requirements. Maintain adequate control so that the stability of excavated and constructed slopes are not adversely affected by water, that erosion is controlled and that flooding of excavations or damage to the structures does not occur. Drain surface water away from the excavations.

3.05 PAINTING

A. Factory painted equipment that has been scratched or marred shall be repainted to match original factory color.

B. All un-insulated black ferrous metal items <u>exposed to sight inside the building</u>, such as standpipes, equipment hangers and supports, shall be cleaned and painted with one (1) coat of zinc chromate primer. In addition, such items in finished spaces shall also be painted with two (2) coats of finish paint in a color to match adjacent surfaces or as otherwise selected by the architect.

C. Black ferrous metal items <u>exposed outside</u> the buildings, such as uninsulated pipe and pipe supports not provided with factory prime coat, shall be cleaned and painted with one (1) coat of rust inhibiting primer and two (2) coats of an asphaltic base aluminum paint.

D. In lieu of painting hanger rods, cadmium plated or galvanized rods may be furnished.

E. No nameplates or equipment shall be painted, or suitable protection shall be afforded to the plates to prevent their being rendered illegible during the painting operation.

F. Galvanizing broken during construction shall be recoated with cold galvanized compound.

G. All ductwork, piping, insulation, conduit or other appurtenances visible through grilles and diffusers shall be painted flat black.

3.06 CUTTING AND PATCHING

A. The contractor shall assume all cost of, and be responsible for, all cutting required to complete the installation of his portion of the work. All cutting shall be carefully and neatly done so as not to damage or cut away more than is necessary of any existing portions of the structure. Concrete patching shall be by general contractor.

3.07 SLEEVES

A. Pipes passing through floor slabs (except grade slabs) shall pass through 16 gauge galvanized metal sleeves. The top of the sleeve shall extend 1" above finished floor and the bottom shall be flush with the underside of the floor slab.

B. Floor sleeves shall allow sufficient room for the pipe or pipe and insulation to pass and leave a 1/2" or greater space between the sleeve and the pipe or pipe insulation. This space shall be caulked with material to meet fire rating of the floor or maintain air-tight, watertight seals.

C. Sleeves for concrete or masonry walls, grade beams, etc. shall be made of schedule 40 black steel pipe and shall be installed to fit flush with each side of wall or beam. Sleeves placed below grade shall be caulked with oakum between the sleeve and the pipe passing through the sleeve. Wall sleeves above grade or on the interior walls of the building shall be caulked between the sleeve and the pipe passing through the sleeve so that the fire rating of the wall is maintained or so that air or moisture can not pass through the sleeve.

3.08 ESCUTCHEONS

A. Escutcheons shall be installed on all pipes where they pass through floors, ceilings, walls or partitions in finished areas.

B. The interior of closets, adjacent to finished areas, shall be considered as finished for the intent of these specifications.

C. Escutcheons shall be split, hinged, stamped brass type designed to fit the pipe, and to cover the terminating pipe sleeve, in chrome plated finish unless otherwise specified, with securing device to hold the escutcheon tight to the pipe.

3.09 CLEANING

A. Flush new water piping systems until water runs clean. Mild chemical cleaning may be required. If so, flush all cleaning chemicals out of the piping system before recharging with water.

B. Remove all stickers, rust, stains, labels, and temporary covers before final acceptance.

C. The exterior surfaces of all mechanical equipment, piping, ducts, etc. shall be cleaned of all grease, oil, paint, dust and other construction debris.

D. Ducts, plenums and casings shall be cleaned of all debris and blown free of all particles of rubbish and dust before installing outlet faces.

E. Bearings that require lubrication shall be lubricated in accordance with the manufacturer's recommendations. Provide written certification of lubrication.

F. Equipment rooms shall be left broom clean.

G. Any fans operating during construction shall have temporary filters. Temporary filters shall be changed regularly to prevent contamination of the equipment and duct systems. Permanent filters shall be installed prior to final inspection.

3.10 GUARANTEE

A. All systems and components shall be provided with a one year guarantee from the time of final acceptance. The guarantee shall cover all materials and workmanship. During this guarantee period, all defects in materials and workmanship shall be corrected by repair or replacement without incurring any additional cost.

B. All air conditioning compressors shall be guaranteed for an additional four years or as specified in equipment sections. This additional guarantee shall include parts only.

3.11 FINAL INSPECTION

A. Final inspection will be scheduled by the architect when he has determined the project is ready for final inspection.

B. The final inspection may require representatives of the mechanical contractor and his various sub-contractors to be present. Proper notification will be given by the architect advising the date and time of the final inspection and the representatives required from the various sub-contractors.

END OF SECTION

SECTION 15030 - MECHANICAL SUBMITTAL DATA

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The requirements of the general conditions, supplementary conditions, and Section 15010 apply to all work herein.

1.02 QUALITY ASSURANCE

A. Shop drawings or fully descriptive catalog data shall be submitted by the contractor for all items of material and equipment furnished and installed under this contract. The contractor shall submit to the architect a sufficient number of copies of all such shop drawings or catalog data to provide him with as many review copies as he may need, plus two (2) copies for retention; one by the architect and one by the engineer.

B. Before submitting shop drawings to the architect for review, the contractor shall examine them and satisfy himself that they are correctly representative of the material or equipment to which they pertain. The contractor shall note these drawings before submitting them. The contractor's review of the shop drawings is not intended to take the place, in any way, of the official review by the architect, and shop drawings which have not been reviewed by the architect shall not be used in fabricating or installing any work. *Any product which has not been listed as an approved equal or received prior approval by written addendum shall not be submitted and, if submittal, the product will be rejected without review.*

C. The review of shop drawings or catalog data by the architect shall not relieve the contractor from responsibility of deviations from the plans and specifications unless he has, in writing, specifically called attention to such deviations at the time of submission and has obtained the permission of the architect thereon; nor shall it relieve him from responsibility for error of any kind in shop drawings.

D. Verification and assignment of dimensions, quantities, and construction means, methods, sequences or procedures, the correctness of which is set forth in the contract documents or submittal, shall be the sole responsibility of the contractor.

E. Reproduction of design documents in any portion for use in a submittal is <u>not</u> acceptable.

1.03 CONTRACTOR'S RESPONSIBILITIES

A. Furnish submittal data consisting of shop drawings, brochures, samples, etc. as defined herein, as indicated on the drawings and as specified herein before purchasing material or performing any installation unless directed by the architect in writing. Work performed or material purchased before the applicable shop drawing has been reviewed and accepted by the engineer is entirely at the risk and expense of the contractor.

B. Any costs incurred due to nonconformance of the contract documents shall not increase the contract sum.

C. The contractor shall submit certification and mechanical/electrical coordination letters with the submittals as specified herein.

D. Resubmittals are due within ten (10) working days from receipt.

1.04 ENGINEER'S RESPONSIBILITIES

A. In general the submittal data review period (both initial and resubmittal) shall be ten (10) working days from receipt; however, ductwork, piping and temperature control fabrication drawings shall be reviewed within fourteen (14) working days from receipt.

B. The engineer's review of these submittals is only for the limited purpose of checking the same for conformity with the design concept of this work as established by the contract documents. This review is not intended to be for the purpose of determining the accuracy of other matters that are contained in such submittals.

PART 2 - PRODUCTS

2.01 GENERAL

A. All products shall be new and bear all labels which are identified by the applicable specification section and contract documents.

PART 3 - EXECUTION

3.01 SUBMITTAL DATA

A. General

1. The submittal data to be furnished for this project shall comply with the specifications and contract documents in their entirety. Any submittals herein scheduled are as a minimum only and shall not be construed to limit the submittal data required within the individual sections of these specifications.

2. Shop drawings will be returned unchecked unless the following information is included: Reference to all pertinent data in the specifications or on the drawings, such as sound power levels of motor driven equipment where called for in the specifications, electrical characteristics and horse power, capacities, construction material of equipment, UL Labels where required, accessories specified, manufacturer, make and model number, weights where specified, starters where required by Division 15, size and characteristics of the equipment, name of the project and a space large enough to accept an approval stamp. <u>The data submitted shall reflect the actual equipment performance under the specified conditions and shall not be a copy of the scheduled data on the drawings.</u> All submitted equipment must be identified on shop drawings with same "Mark Numbers" as identified on drawings or in specifications. All pertinent data such as accessories shall also be marked. Any deviation from any part of the contract documents shall be clearly and completely highlighted.

3. HVAC and plumbing submittal data shall be bound into separate HVAC and plumbing volumes, with each volume containing one copy of all specified equipment shop drawings. The binders shall be provided with an identification tab for each specification section that requires submittals. Each item in each tabbed section shall be identified with the paragraph number relating to the item submitted by the use of a cover sheet or by highlighting the paragraph on the first page concerning the item. If necessary, binders shall be submitted with the original submittal data and will address and resolve all comments thereon. All submittals shall include identification tabs and sufficient space for all submittal data.

   FAILURE to provide BOUND AND IDENTIFIED SUBMITTALS will result in the AUTOMATIC REJECTION of the submittal data with NO EXCEPTION.

4. The bound submittals are to be submitted for review within 30 days after the contract is awarded. No submittal will be checked until ALL required submittals have been received by the engineer. Only Automatic Temperature Controls, ductwork and piping fabrication drawings may be submitted after the complete and bound submittal is reviewed and accepted by the engineer.

5. The contractor shall submit with the bound and identified submittal data a letter signed by the contractor's Project Manager (or higher level officer of the firm) stating that all electrical characteristics of the mechanical equipment to be supplied have been fully coordinated with the electrical contractor. No submittal data will be checked until this letter is submitted. Any changes to the electrical requirements from the contract documents resulting from alternate equipment being submitted shall be performed <u>without</u> any additions to the contract sum. Shop drawings shall be submitted for each of the following when equipment is included as part of the mechanical installation:

<u>HVAC</u>

Automatic Temperature Controls (Cuts of Instruments, Controllers and Valves, Description of System Operation, Ladder Diagram, Control Wiring Diagram from Terminal to Terminal, Control Systems Power Requirements)
Condenser Units
Cooling/Heating Equipment
Curbs
Dampers
Electric Heating Units
Exhaust Fans
Flexible Duct
Flue Venting Materials
Furnaces
Grilles, Registers and Diffusers
Hangers
Insulation
Sprinkler System Drawings, Calculations, Cut Sheets
Valves
Water Heaters

<u>PLUMBING</u>

Backflow Preventers
Cleanouts (Floor, Grade, Wall)
Drinking Fountains
Gas Cocks
Handicap Fixtures
Hydrants
Insulation
Plumbing Fixtures, Carriers, Trim
Trap Primers
Water Heaters

3.02 OPERATING AND MAINTENANCE INSTRUCTIONS

A. DESCRIPTION

1. Complete operating and maintenance instructions shall be provided to the owner. Four (4) separate copies (three for the owner, one for the architect) shall be provided, and each copy shall be bound in a separate 3-ring, loose leaf notebook. Operating instructions shall be provided for each system, and shall include a brief system description, a simple schematic and a sequence of operation. Operating and maintenance instructions shall be included for each piece of equipment. Manufacturer's standard literature is acceptable for each piece of equipment. However, the contractor shall prepare a SYSTEM O&M manual including overall system descriptions, operating and energy conservation techniques.

2. A system wiring and control diagram shall be included in the operating and maintenance instructions.

3. Prior to final acceptance or beneficial occupancy, provide the services of a competent representative to instruct the owner in the operation of all systems. This instruction shall include a complete walk-through of all equipment and systems. The architect/engineer reserves the right to attend any such meeting and shall be duly notified.

3.03 OTHER SUBMITTALS

A. Submit or provide the following prior to occupancy of the project by the owner:

1. As built drawings for ductwork, HVAC piping, plumbing and utilities.

2. All warranties.

3. Certify disinfection of domestic water service by proper authority.

4. Provide start-up, test and balance report, as specified.

5. Manufacturer's representative shall certify that HVAC equipment is installed in accordance with the manufacturer's recommendations.

END OF SECTION

SECTION 15060 - PIPE, FITTINGS AND JOINING PROCEDURES

PART 1 - GENERAL

1.01 SCOPE

A. Provide all material, equipment and labor, etc. required to complete installation specified and/or shown or scheduled on plans.

B. Work included:

1. Pipes, fittings, unions, couplings, flanges, gaskets, and other materials and instructions.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 15010 - General Conditions for Mechanical Work

B. Section 15100 - Valves

C. Section 15120 - Piping Specialties

D. Section 15140 - Hangers, Supports and Anchors

E. Section 15190 - Mechanical Identification

F. Section 15250 - Mechanical Insulation

PART 2 - PRODUCTS

2.01 PIPING AND FITTING MATERIALS

A. General: Provide pipe tube and fittings of type, joint type, grade, size and weight (wall thickness or class) indicated for each service. Where type, grade or class is not indicated, provide proper selection as determined by installer for installation requirements, and comply with governing regulations and industry standards.

B. All fittings shall conform to pipe as to black steel, PVC plastic, copper or cast iron, etc. or as indicated. Fittings and accessories shall have equal or greater pressure rating than piping specified for specific application. Piping materials placed in air conditioning plenums or plenum chambers or other spaces used for environmental air handling purposes shall have a flamespread of not more than 25 and a smoke developed rating of not more than 50 when tested in accordance with ASTM E84. All such materials shall meet the requirements of noncombustible building materials as defined by the Standard Building Code or the material shall be enclosed within a fire resistant assembly meeting the noncombustible requirements.

C. Malleable steel fittings will be 150 psi, with unions having bronze to iron ground joints.

D. Furnish and install unions or mating flanges at all connections to each piece of equipment conveniently located to facilitate quick and easy disconnecting of equipment. Flanges or union connections shall be used on both sides of traps, control valves, pressure reducing valves and meters and the like.

E. Provide ground joint union, factory made reducers and increasers, and nipples of comparable materials as the piping with which it is installed and capable of withstanding the same working pressure. The use of bushings is not acceptable to obtain reduction or increase in sizes.

F. Provide dielectric fittings where copper and ferrous metal are joined.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Install pipe, tube and fittings in accordance with recognized industry practices which will achieve permanently leakproof piping systems, capable of performing each indicated service without piping failure. Install each run with minimum joints and couplings, but with adequate and accessible unions for disassembly and maintenance/replacement of valves and equipment. Align piping accurately at connections, within 1/16" misalignment tolerance. Comply with ANSI B30 Code for Pressure Piping.

B. Locate piping runs, except as otherwise indicated, vertically and horizontally (pitched to drain) and avoid diagonal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details and notations, or if not otherwise indicated, run piping in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold piping close to walls, overhead construction, columns and other structural and permanent enclosure elements of building; limit clearance to 1/2" where furring is shown for enclosure or concealment of piping, but allow for insulation thickness, if any. Where possible, locate insulated piping for 1.0" clearance outside insulation. Wherever possible in finished and occupied spaces, conceal piping from view, by locating in column enclosures, in hollow wall construction or above suspended ceilings; do not encase horizontal runs in solid partitions, except as indicated.

C. Electrical Equipment Spaces: Do not run piping through transformer vaults and other electrical or electronic equipment spaces and enclosures.

D. Piping System Joints: Provide joints of type indicated in each piping system.

1. Thread pipe in accordance with ANSI B2.1; cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint compound, or pipe joint tape (Teflon) where recommended by pipe/fitting manufacturer, on male threads at each joint and tighten joint to leave not more than 3 threads exposed.

2. Braze copper tube-and-fitting joints where indicated, in accordance with ANSI B30.

3. Solder copper tube-and-fitting joints where indicated, in accordance with recognized industry practice. Cut tube ends squarely, ream to full inside diameter, and clean outside of tube ends and inside of fittings. Insert tube full depth into fitting, and solder in manner which will draw solder full depth and circumference of joint. Wipe excess solder from joint before it hardens.

4. Mechanically Formed Tee Connections: In lieu of providing tee fittings in copper tubing, installer may, as option, provide mechanically formed tee connections, providing they are in accordance with the following:

A. Size and wall thickness of both run tube and branch tube are listed by manufacturer of forming equipment as "Acceptable Application".

B. Height of drawn collar is not less than 3 times wall thickness of run tubing.

C. End of branch tube is notched to conform to inner curve of run tube, and dimpled to set exact penetration depth into collar.

D. Resulting joint is minimum of 3 times as long as thickness of thinner joint member, and brazed using B-cup series filler metal.

5. Mechanically Formed Couplings: In lieu of providing couplings in copper tubing, installer may, as option, provide mechanically formed couplings, provided they are in accordance with the following:

   A. Form couplings by first annealing area at end of tube where expansion will occur. Insert tube expander to die size required and expand tube end to accept tubing of same size.

   B. Resulting joint is minimum of 3 times as long as thickness of tube, and brazed using B-cup series filler metal.

6. Weld pipe joints in accordance with recognized industry practice and as follows:

   A. Weld pipe joints only when ambient temperature is above 0 degrees F where possible. Bevel pipe ends at a 37.5 angle, smooth rough cuts, and clean to remove slag, metal particles and dirt.

   B. Use pipe clamps or tack-weld joints with 1" long welds; 4 welds for pipe sizes to 10", 8 welds for pipe sizes 12" to 20".

   C. Build up welds with stringer-bead pass, followed by cover or filler pass. Eliminate valleys at center and edges of each weld. Weld by procedures which will ensure elimination of unsound or unfused metal, cracks, oxidation, blow-holes and non-metallic inclusions.

   D. Do not weld-out piping system imperfections by tack-welding procedures; refabricate to comply with requirements.

   E. At installer's option, install forged branch-connection fittings wherever branch pipe of size smaller than main pipe is indicated; or install regular "T" fitting.

7. Weld pipe joints of steel water pipe in accordance with AWWA C206.

8. Flanged Joints: Match flanges within piping system, and at connections with valves and equipment. Clean flange faces and install gaskets. Tighten bolts to provide uniform compression of gaskets.

9. Lead Joint Installation: Tightly pack joint with joint packing material. Do not permit packing to enter bore of finished joint. Clean joint after packing. Fill remaining joint space with one pouring of lead to indicated minimum depth measured from face of bell. After lead has cooled, caulk joint tightly by use of a hammer and caulking iron.

10. Hubless-Cast-Iron Joints: Comply with coupling manufacturer installation instructions.

11. Clay Pipe Joints: Comply with ASTM C12.

12. Plastic Pipe/Tube Joints: Comply with manufacturer's instructions and recommendations, and with applicable industry standards:

    A. Heat Joining of Thermoplastic Pipe: ASTM D2657.

    B. Making Solvent-Cemented Joints; ASTM D2235 and ASTM F402.

13. Glass Pipe Joints: Comply with manufacturer's instructions and recommendations.

3.02 CLEANING, FLUSHING AND INSPECTING

A. General: Clean interior surfaces of installed piping systems of superfluous materials, and prepare for application of specified coatings (if any). Flush out piping systems with clean water before proceeding with required tests. Inspect each run of each system for completion of joints, supports and accessory items. Inspect pressure piping in accordance with procedures of ANSI B30.

B. Disinfect water mains and water service piping in accordance with AWWA C601 and local authority.

3.03 PIPING TESTS

A. Notify architect/engineer at least 24 hours before performing leak test.

B. Provide temporary equipment for testing, including pumps and gages. Test piping system before insulation is installed wherever feasible, and remove control devices before testing. Test each natural section of each piping system independently but do not use piping system valves to isolate sections where test pressure exceeds valve pressure rating. Fill each section with water and pressurize for system at 150% of operating pressure indicated, but not less than 25 psi test pressure. Observe each test execution for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds 5% of test pressure.

C. Repair piping system sections which fail required piping test by disassembly and re-installing, using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods.

D. Drain test water from piping systems after testing and repair work has been completed.

3.04 THRUST BLOCKS

A. All changes in direction of underground fiberglass or plastic pressure systems for 2" and larger systems shall be encased in concrete (3000 psi) thrust blocks to provide anchor points for direct expansion and contraction. All water main piping underground shall have thrust blocks installed at changes in direction or tee branches.

3.05 MANUFACTURER'S ASSISTANCE

A. Manufacturer shall provide, if required, a factory trained service man to properly train contractor's personnel in all phases of installation.

END OF SECTION

SECTION 15070 - PIPING SCHEDULE

PART 1 - GENERAL

1.01 SCOPE

A. Provide piping systems as specified and shown on drawings in accordance with Section 15060.

B. Provide optional systems for different code requirements only if approved by engineer prior to beginning installation of piping.

C. Piping materials placed in air conditioning plenums or plenum chambers or other spaces used for environmental air handling purposes shall have a flamespread of not more than 25 and a smoke developed rating of not more than 50 when tested in accordance with ASTM E84. All such materials shall meet the requirements of noncombustible building materials as defined by the Standard Building Code or the material shall be enclosed within a fire resistant assembly meeting the noncombustible requirements.

PART 2 - PRODUCTS

2.01 PIPING SCHEDULE

A. Sanitary waste and vent above slab within building:

1. Pipe size 10" or smaller: No-hub cast iron soil pipe, CISPI 301.

a. Pipe Class: Service weight (SV).

b. Fittings: No-hub cast iron soil pipe fittings, CISPI 301 with stainless steel clamps and Neoprene gaskets.

c. Gaskets: Neoprene gasket joints, ASTM C-564.

d. Couplings: "Husky" heavy duty stainless steel clamps, CISPI 301.

2. Option if allowed by local code authorities and if in compliance with Section 15020-3.12 A, B, and C where applicable:

Schedule 40 PVC with solvent weld fittings or mechanical joint fittings.

B. Sanitary waste and vent and oil waste underground; sanitary waste and vent above ground larger than 10":

1. Pipe: Cast iron, hub and spigot soil pipe, ASTM A74.

   a. Pipe Class: Service weight (SV).

   b. Fittings: Cast iron, hub and spigot soil pipe fittings.

   c. Gaskets: Neoprene compression gasket joints, ASTM C-564.

2. Option if allowed by local code authorities and if in compliance with Section 15020-3.12 A, B, and C where applicable.

   Schedule 40 PVC with solvent weld fittings or mechanical joint fittings.

C. Domestic water piping; above ground:

1. All size, copper tube, lead free.

   a. Wall Thickness: Type L, hard drawn temper.

   b. Fittings: Wrought copper or cast bronze.

   c. Solder: 95-5 tin-antimony with compatible flux. Solder and fluxes shall be lead free.

D. Domestic Water Underground:

1. Tube size 1/2" through 2": Copper tube, lead free.

   a. Wall Thickness: Type K, soft-annealed temper.

   b. Fittings: Wrought copper or cast bronze.

   c. Solder: Silver solder, lead free..

2. Tube size 2-1/2" through 4": Same as Item #1 above except Type K hard drawn copper.

3. Pipe size larger than 4": Ductile-iron pipe, with cement-mortar lining, push-on joints.

a. Pipe weight: Class 50.

b. Fittings: Class 250 ductile-iron, mechanical joints.

c. Option if allowed by local code authorities:

PVC pipe C-900, Class 150, SDR-18 for pipe larger than 4". (UL approved for fire service for sprinkler mains).

E. Condensate drains (HVAC), equipment drains, relief valve discharge drain piping:

1. All sizes copper water tube.

a. Type L.

b. Fittings: Wrought copper or cast bronze.

c. 50/50 solder.

2. Option if allowed by local code authorities and if in compliance with Section 15020-3.12 A, B, and C where applicable:

Schedule 40 PVC for condensate drains.

F. Refrigerant piping - above slab:

1. All sizes.

a. Type ACR hard drawn copper tubing.

b. wrought copper fittings.

c. silver solder brazed joints.

G. Refrigerant piping - below slab:

1. All sizes.

a. Type ACR soft drawn copper tubing, no joints below slab.

H. Natural gas piping - above ground:

1. Pipe size up to and including 2":

   a. Type: Black steel pipe.

   b. Class: Schedule 40, ASTM A-53.

   c. Fittings: Class 150 mallable iron threaded.

   d. Joints: Threaded.

2. Pipe size 2-1/2" and larger:

   a. Type: Black steel pipe.

   b. Class: Schedule 40, ASTM A-53.

   c. Fittings: Standard weight wrought steel, butt-welded fitting.

   d. Joints: Buttwelded.

I. Natural gas piping - underground:

1. All pipe sizes 1/2" and larger:

   a. Type: Black steel, Schedule 40.

   b. Wrap: Machine wrapped X-Tru-Coat, hand wrap joints.

   c. Joints: Butt-weld.

2. OptionPipe size

   a. Thermoplastic gas pressure pipe.

   b. Tubing and fittings complying with ASTM D 2513.

   c. High and medium pressure piping outside of building and below grade from meter/regulator to gas main connection shall be Schedule 40 polyethylene and shall conform to the requirements of thermoplastic pipe as outlined in ANSI 31.8 for gas transmission. Riser to meter and extending five feet horizontally below grade shall be black steel pipe with asphalt based coating and plastic jacketed anodeless riser.

PART 3 - EXECUTION

3.01 TESTING

A. Sanitary waste and vent piping, - in accordance with local code.

B. Domestic water piping - 200 psig for 4 hours.

C. Refrigerant piping, - 250 psig for 4 hours.

3.02 IDENTIFICATION

A. All piping to be identified with permanent markers as to service. (See Section 15190).

B. Provide copper wire tracer for underground non-metallic piping. Place on pipe prior to backfill. (See Section 15190, 3.01 D.)

END OF SECTION

SECTION 15140 - HANGERS, SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Extent of supports and anchors, specified in this section is indicated on drawings and/or specified in other Division 15 sections.

B. Types of supports and anchors specified in this section include horizontal piping hangers and supports, vertical piping clamps, hanger rod attachments, building attachments, saddles and shields, and equipment supports.

1.02 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Supports, anchors furnished as part of factory-fabricated equipment, are specified as part of the equipment assembly in other Division 15 sections.

B. Concrete housekeeping bases, 15010.

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of supports and anchors of types and sizes required, whose products have been in satisfactory use in similar service.

B. Code Compliance: Comply with applicable codes pertaining to product materials and installation of supports, anchors.

1.04 SUBMITTALS

A. Comply with Section 15030. Submit catalog cuts, specifications, installation and instructions for each type of support and anchor.

PART 2 - PRODUCTS

2.01 HORIZONTAL PIPING HANGERS

A. Where 2 or more lines run parallel, lines may be supported with angle iron trapeze type hangers properly sized to support load of piping and piping contents.

B. Individual lines shall be supported using split-ring Grinnell Figure 108 or clevis type hangers Grinnell Figure 260 sized for pipe being supported, including insulation. Provide copper plated hangers Grinnell Figure CT-109 for copper un-insulated lines or in cases where hanger comes in direct contact with copper pipe.

2.02 VERTICAL PIPE SUPPORTS

A. Vertical lines passing through floor slabs shall be supported with riser clamps equal to Grinnell Figure 261. Copper lines coming in contact with the hanger shall be supported with copper plated riser clamps.

B. Vertical lines requiring support at elbow connections shall be supported using Grinnell Figure 192 pipe stanchion supports.

2.03 SADDLES AND SHIELDS

A. Except as otherwise indicated, provide saddles or shields under piping hangers and supports, factory or shop fabricated, for all insulated piping. Size saddles and shield for exact fit to mate with pipe insulation, 12" long.

2.04 SUPPORT AND BUILDING ATTACHMENTS

A. Hangers and supports shall be attached to the building as follows:

(1) from wood using coach screw on open construction and hanger flanges on sheeting, (2) from concrete using inserts, (3) from steel using beam clamps, rivets or bolts, (4) from concrete blocks using toggle or through bolts. Fasten supports to building in following order of preference: (1) steel framing, (2) concrete, (3) wood framing, (4) masonry, (5) wood sheeting. Do not support from roof deck without approval. All hangers, rods, and inserts shall be Underwriters' Laboratories approved for the service intended.

B. Piping shall not be run within bar joist webbing. Piping shall not rest directly on building structural steel but shall be supported with proper hangers and attachments.

2.05 ROOF EQUIPMENT SUPPORTS

A. General: Construct roof equipment supports using minimum 18-ga. galvanized steel with fully mitered and welded corners, 3" cant, internal bulkhead reinforcing, integral base plates, pressure treated wood nailer, and

18-ga. galvanized steel counter flashing. Roof mounted equipment such as rooftop air conditioning units, make-up air units and exhaust/supply fans shall be provided with factory curbs as a part of the rooftop equipment unless otherwise noted.

B. Configuration: Construct to sizes as indicated, compensate for slope in roof so top of support is level and a minimum of 14" clearance is maintained between top of curb and finished roof.

C. Equipment and pipe supports other than those provided with rooftop units, etc. shall be equal to Pate Company or Custom Curb, Inc.

2.06 ANCHORS

A. Piping requiring anchoring to the structure to prevent or limit movement shall be anchored using all-directional type anchors equal to Mason Type ADA. Provide necessary riser clamps or hangers.

PART 3 - EXECUTION

3.01 PIPING SUPPORT

A. All hangers for insulated piping shall be sized to accommodate insulation and shield. No hangers for insulated piping may be installed directly on pipe.

B. Maximum spacing between pipe supports to prevent excessive stress: This does not apply where there are concentrated loads between supports:

	Pipe Size	Rod Dia.	Steel Max. Spac.	Copper Max. Spac.	PVC Max. Spac.	Cast Iron Max. Spac.
1.	Up to 1/2"	1/4"	5 ft.	4 ft.	3-1/2 ft.	--
2.	3/4" - 1"	3/8"	6 ft.	5 ft.	4 ft.	--
3.	1-1/4"	3/8"	6 ft.	6 ft.	4 ft.	--
4.	1-1/2"	3/8"	9 ft.	8 ft.	4 ft.	--
5.	2",2-1/2",3"	3/8"	10 ft.	8 ft.	4 ft.	5 ft.

6. 4" & Larger 1/2" 10 ft. 10 ft. 4 ft. 5 ft.

C. Install hangers and supports complete with necessary bolts, rods, nuts, washers and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.

D. Provisions for Movements

1. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate action of expansion bends and similar units.

2. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

3. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes.

END OF SECTION

SECTION 15170 - MOTOR STARTERS AND CONTROLS

PART 1 - GENERAL

1.01 SCOPE

A. Provide motor starting equipment necessary to automatically start and stop electric motors furnished as part of Division 15 - Mechanical.

B. Provide push-buttons, hand-off-auto switches, pilot lights, interlock contacts, overload heaters, motor starter enclosures and proper holding coils for control of motor starters and related equipment.

1.02 RELATED WORK

A. Electrical power wiring and motor control centers - Division 16.

B. Section 15800 - Temperature Controls Basic Materials and Methods.

C. General - Bidding and/or negotiations requirements, general conditions of the contract, supplementary conditions, pertinent portions of sections in Division 1 of the project specifications and the drawings shall apply to the work of this section.

1.03 QUALITY ASSURANCE

A. Manufacturer comply with NEC, UL, NFPA, IEEE Standard 241 and NEMA.

1.04 SUBMITTALS

A. Comply with Section 15030. Submit manufacturers literature showing starter size, coil voltage, auxiliary contacts, enclosure type and specific equipment to be used with.

PART 2 - PRODUCTS

2.01 MOTOR STARTERS

A. Provide motor starters equal to Cutler-Hammer, Square-D, Allen Bradley, Siemens or General Electric.

B. Provide across-the-line or combination starter/disconnects, full voltage A-C current motor starters for controlling three phase motors. Provide NEMA 1 enclosure unless specified or indicated otherwise. Provide hand-off-auto switch, overload reset, green running light, and one (1) spare set of auxiliary contacts.

Furnish proper holding coil for use with control system requirements, 3 overload heaters sized for full load amps of motor to be controlled. Starters equal to Cutler-Hammer Series A-10.

C. Provide manual starters for single phase motors with quick-make, quick-break toggle switch, green pilot light, thermal overload, and padlock connection. Starters equal to Cutler-Hammer 9101H111, suitable for flush mounting.

2.02 REMOTE PILOT DEVICES

A. Push-button stations shall be Cutler-Hammer Series E10 with NEMA 1 enclosures and pilot light.

B. Hand-off-auto switches shall be Cutler-Hammer Series E20, Category 10250T21KB mounted in NEMA 1 enclosure with pilot light.

PART 3 - EXECUTION

3.01 INSTALLATION AND MOTOR STARTERS

A. Install motor starters as indicated, in accordance with equipment manufacturer's written instructions and with recognized industry practices; complying with applicable requirements of NEC, UL and NEMA standards, to insure that products fulfill requirements.

B. Coordinate with other work including motor and electrical wiring/cabling work, as necessary to interface installation of motor starters with other work.

C. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standard 486A.

D. Subsequent to connecting wires/cable, energize motor starter circuitry and demonstrate functioning of equipment in accordance with requirements; where necessary correct malfunctioning units, and then retest to demonstrate compliance. Ensure that direction of rotation of each motor fulfills requirements.

END OF SECTION

SECTION 15190 - MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Extent of mechanical work required by this section is indicated on drawings and/or specified in other Division 15 sections.

B. Types of identification devices specified in this section include painted identification materials, plastic pipe markers, plastic tape, underground-type plastic line marker, valve tags, valve schedule frames, engraved plastic-laminate signs, and plasticized tags.

1.02 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Mechanical identification furnished as part of factory-fabricated equipment, is specified as part of the equipment assembly in other Division 15 sections.

1.03 QUALITY ASSURANCE

A. Comply with ANSI Standards A13.1 for lettering size, colors, and viewing angles of identification devices.

1.04 SUBMITTALS

A. Comply with Section 15030.

B. Product Data: Submit product specifications and installation instruction for each identification material and device required.

C. Maintenance Materials: Furnish minimum of 5% extra stock of each mechanical identification material required, including additional numbered valve tags (not less than 3) for each piping system, additional piping system identification markers, and additional plastic laminate engraving blanks of assorted sizes. Where stenciled markers are provided, clean and retain stencils after completion of stenciling and include used stencils in maintenance materials, along with required stock of stenciling paints and applicators.

PART 2 - PRODUCTS

2.01 MECHANICAL IDENTIFICATION MATERIALS

A. Provide manufacturer's standard products of categories and types required for each application as referenced in other Division 15 sections. Where more than single type is specified for application, selection is installer's option, but provide single selection for each product category. W. H. Brady Company, Signmark Div. or Seton Name Plate Corporation.

B. Painted Identification Materials:

1. Stencils: Standard fiberboard stencils, prepared for required applications with letter sizes generally complying with recommendations of ANSI A13.1 for piping and similar applications, but not less than 1-1/4" high letters for ductwork, and not less than 3/4" high letters for access door signs and similar operations instructions.

2. Stencils Paint: Standard exterior type stenciling enamel, black except as otherwise indicated; either brushing grade or pressurized spray-can form and grade.

3. Identification Paint: Standard identification enamel of colors indicated or, if not otherwise indicated for piping systems, comply with ANSI A13.1 for colors.

C. Plastic Pipe Markers: Provide manufacturer's standard pre-printed, flexible or semi-rigid, permanent, color-coded, plastic-sheet pipe markers, complying with ANSI A13.1.

1. Small Pipes: For external diameters less than 6" (including insulation if any), provide full-band pipe markers, extending 360 degrees around pipe at each location, fastened by one of the following methods:

   Snap-on application of pre-tensioned semi-rigid plastic pipe marker.

   Adhesive lap joint in pipe marker overlap.

Laminated or bonded application of pipe marker to pipe (or insulation).

Taped to pipe (or insulation with color-coded plastic adhesive tape, not less than 3/4" wide; full circle at both ends of pipe marker, tape lapped 1-1/2".

2. Large Pipes: For external diameters of 6" and larger (including insulation of any), provide either full-band or strip-type pipe markers, but not narrower than 3 times letter heights (and of required length), fastened by one of the following methods:

Laminated or bonded application of pipe marker to pipe (or insulation).

Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 1-1/2" wide; full circle at both ends of pipe marker, tape lapped 3".

3. Comply with piping system nomenclature as specified, scheduled or shown, and abbreviate only as necessary for each application length. Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as separate unit of plastic.

D. Underground-Type Plastic Line Marker: Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 6" wide x 4 mils thick. Provide tape with printing which most accurately indicates type of service buried pipe.

E. Valve Tags:

1. Brass Valve Tags: Provide 19-gage polished brass valve tags with stamp-engraved piping system abbreviation in 1/4" high letters and sequenced valve numbers 1/2" high, and with 5/32" hole for fastener. Provide 1-1/2" diameter tags, except as otherwise indicated. Provide size and shape as specified or scheduled for each piping system.

2. Plastic Laminate Valve Tags: Provide manufacturer's standard 3/32" thick engraved plastic laminate valve tags, with piping system

abbreviation in 1/4" high letters and sequenced valve numbers 1/2" high, and with 5/32" hole for fastener. Provide 1-1/2" sq. black tags with white lettering, except as otherwise indicated. Provide size, shape, and color combination as specified or scheduled for each piping system.

3. Plastic Valve Tags: Provide manufacturer's standard solid plastic valve tags with printed enamel lettering, with piping system abbreviation in approximately 3/16" high letters and sequenced valve numbers approximately 3/8", and with 5/32" hole for fastener. Provide 1-1/8" sq. white tags with black lettering.

4. Valve Tag Fasteners: Manufacturer's standard solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.

F. Valve Schedule Frames: For each page of the valve schedule, provide a glazed display frame, with screws for removable mounting on masonry walls. Provide frames of finished hardwood or extruded aluminum, with SSB-grade sheet glass.

G. Access Panel Markers: Provide manufacturer's standard 1/16" thick engraved plastic laminated access panel markers, with abbreviations and numbers corresponding to concealed valve. Include 1/8" center hole to allow attachment.

H. Engraved Plastic-Laminate Signs: Provide engraving stock melamine plastic laminate in the sizes indicated, engraved with engraver's standard letter style of the sizes and wording indicated, black with white core (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.

1. 1/8" thick, except as otherwise indicated.

2. Fasteners: Contact-type permanent adhesive.

I. Plastic Equipment Markers: Provide manufacturer's standard laminated plastic, equipment markers, 4-1/2" x 6" size, white letter on red background.

J. Plasticized Tags: Manufacturer's standard pre-printed or partially pre-printed accident-prevention tags, or plasticized card stock with matt finish suitable for writing, approximately 3-1/4" x 5-5/8", with brass grommets and wire fasteners, and with appropriate pre-printed wording including large-size primary wording (as examples; DANGER, CAUTION, DO NOT OPERATE).

PART 3 - EXECUTION

3.01 APPLICATION AND INSTALLATION

A. General Installation Requirements: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

B. Piping System Identification: Install pipe markers of one of the following types on each system indicated to receive identification, and include arrows to show normal direction of flow:

1. Stenciled markers, including color-coded background band or rectangle, and contrasting lettering of black or white. Extend color band or rectangle 2" beyond ends of lettering.

2. Plastic pipe markers, with application system as indicated under "Materials" in this section.

3. Stenciled markers, black or white for best contrast, wherever continuous color-coded painting of piping is provided.

C. Locate pipe markers and color bands as follows wherever piping is exposed to view in occupied spaces, mechanical rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior non-concealed locations.

1. Near each valve and control device.

2. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch, where there could be question of flow pattern.

3. Near locations where pipes pass through walls or floors/ceilings, or enter non-accessible enclosures.

4. At access doors, manholes and similar access points which permit view of concealed piping.

5. Near major equipment items and other points of origination and termination.

6. Spaced intermediately at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment.

7. On piping above removable acoustical ceilings, except omit intermediately spaced markers.

D. Underground Piping Identification: During backfilling/top-soiling of each exterior underground piping systems, install continuous underground-type plastic line marker, located directly over buried line at 6" to 8" below finished grade. Where multiple small lines are buried in common trench and do not exceed overall width of 16", install single line marker. Install copper tracer wire on all non-metallic underground piping, wire to be #14 gauge THW strapped to pipe at 20' intervals.

E. Valve Identification: Provide valve tag on every valve, cock and control device in each piping system; exclude check valves, valves within factory-fabricated equipment units, plumbing fixture faucets, convenience and hose bibs, and shut-off valves at plumbing fixtures, HVAC terminal devices and similar rough-in connections of end-use fixtures and units. List each tagged valve in valve schedule for piping system.

1. Mount valve schedule frames and schedules in machine rooms where indicated or, if not otherwise indicated, where directed by architect/engineer.

F. Mechanical Equipment Identification: Install engraved plastic laminate sign on or near each major item of mechanical equipment and each operational device, as specified herein if not otherwise specified for each item or device. Provide signs for the following general categories of equipment and operation devices:

1. Fuel-burning units including boilers.

2. Pumps, compressors, condensers, and similar motor-driven unit.

3. Fans, blowers, primary balancing dampers.

4. Packaged HVAC central-station and zone-type units.

5. Tanks and pressure vessels.

6. Filter water treatment systems and similar equipment.

END OF SECTION

SECTION 15250 - MECHANICAL INSULATION

PART 1 - GENERAL

1.01 SCOPE

A. Piping System Insulation: Domestic water, refrigerant suction lines, condensate drains.

B. Ductwork System Insulation.

1.02 QUALITY ASSURANCE

A. Installer: A firm with successful installation experience on projects with mechanical insulation's similar to that required for this project.

B. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread rating of 25 or less, and smoke-developed rating of 50 or less, as tested by ASTM E 84 (NFPA 255) method.

C. Insulation materials placed in air conditioning plenums or plenum chambers or other spaces used for environmental air handling purposes shall have a flamespread of not more than 25 and a smoke developed rating of not more than 50 when tested in accordance with ASTM E84. All such materials shall meet the requirements of noncombustible building materials as defined by the Standard Building Code or the material shall be enclosed within a fire resistant assembly meeting the noncombustible requirements.

1.03 SUBMITTALS

A. Comply with Section 15030.

B. Product Data: Submit manufacturer's specifications and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, thickness, and furnished accessories for each mechanical system requiring insulation.

C. Certifications: Submit manufacturer's certifications to show compliance with these specifications and governing regulations. Include proof of compliance for test of products for fire rating, corrosiveness, and compressive strength.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label affixed showing fire hazard ratings of products.

B. Protect insulation against dirt, water, chemical or mechanical damage. Do not install damaged insulation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Armstrong World Industries, Inc., Certainteed Corporation, Johns-Manville Corporation, Owens-Corning Fiberglass Corporation, or Pittsburg Corning Corporation.

2.02 PLUMBING PIPING SYSTEM INSULATION

A. Insulation Omitted: Omit insulation on chrome-plated exposed piping (except for handicapped fixtures), air chambers, unions, strainers, check valves, balance cocks, flow regulators, drain lines from water coolers, drainage piping located in crawl spaces or tunnels and pre-insulated equipment.

B. Cold Piping: Insulate domestic cold water piping with -1/2” fiberglass.

Hot Piping: Insulate domestic hot water piping with 1” thick fiberglass for pipe sizes up to and including 2” 1-1/2” thick for pipe sizes over 2”. Runouts to fixtures not exceeding 12 ft. may be insulated with ½” thick fiberglass. insulated with 1/2" thick fiberglass.

C. Insulate handicapped fixtures having exposed drains and water supplies with factory insulation kit equal to TruBro or Plumbcreek.

2.03 HVAC PIPING SYSTEM INSULATION

A. Cold Piping (40 degrees F to ambient):

1. Insulate air conditioning condensate drain piping refrigerant suction with ½” inch lines fiberglass pipe covering with vapor barrier or ½” flexible unicellular insulation.

2.04 EXTERIOR INSULATION

A. All domestic water, water piping exposed to the weather outside the building shall be insulated as specified above and wrapped with aluminum jacketing.

2.05 DUCTWORK INSULATION (EXTERNAL)

A. Insulate all rectangular and round ductwork externally with 1-1/2" thick flexible fiberglass with vapor barrier having a minimum R-value of 5.0. (See Division 15700).

B. Insulate cooling terminal units located above ceiling unless factory insulated with minimum 1" fiberglass or equivalent, HVAC plenums with unit housings not pre-insulated at factory with 1-1/2" thick rigid fiberglass with vapor barrier.

C. Toilet exhaust ducts and other exhaust systems exhausting air from air conditioned spaces shall be internally lined with 1/2" thick duct liner or wrapped externally with 1/2" fiberglass ductwrap. (See Division 15700).

PART 3 - EXECUTION

3.01 GENERAL

A. Insulation materials shall not be applied until all systems tests have been satisfactorily completed and surfaces to be insulated have been cleaned and dried. Insulation shall be clean and dry when installed and during the application of any finish. Install materials neatly with smooth and even surfaces with jackets drawn tight and smoothly cemented down on longitudinal and end laps. Scrap pieces shall not be used where a full-length section will fit. Pipe insulation shall be continuous through sleeves, wall and ceiling openings, except at fire dampers in duct systems. Piping and ductwork shall be individually insulated. A complete moisture and vapor seal shall be provided wherever insulation terminates against metal hangers, anchors and other projections through insulation on surfaces for which a vapor seal is specified. Chrome plated pipes shall not be insulated. Omit insulation from vibration isolating connections, but adjacent insulation shall be neatly terminated and beveled and sealed. Fan nameplates, access plates in fan housings and ducts must be carefully beveled and sealed around.

3.02 PIPE INSULATION

A. Fiberglass:

Sections of insulation shall be placed around the pipe tightly butted into place. The jacket laps shall be drawn tight and smooth and secured with a factory applied self sealing lap. Circumferential joints shall be covered with butt strips, not less than 3" wide, of material identical to the jacket material. Adhesive used to secure the butt strip shall be the same as used to secure the jacket laps. When a vapor barrier is required, seams shall be sealed with a brush coat of fire resistant vapor barrier coating, applied at all longitudinal and circumferential laps. End of sections of insulation that butt against flanges, unions, valves, and fittings, and joints at intervals of not more than 12 feet on continuous runs of pipe shall be coated with a vapor barrier coating. Breaks and punctures in the jacket material shall be patched by wrapping a strip of jacket material around the pipe and cementing, coating as specified for butt strips. The patch shall extend not less than 1-1/2" past the break in both directions. At penetrations such as thermometers, the voids in the insulation shall be filled with vapor barrier coating and the penetration sealed with a brush coat of the same coating. Insulation shall be additionally secured on 18" centers with 1/2" wide aluminum bands.

B. Flexible Unicellular Insulation:

Bond cuts, butt joints, ends, and longitudinal joints with adhesive. Miter 90 degree turns and elbows, tees, and valve insulation. Where pipes penetrate fire walls, provide mineral fiber or calcium silicate insulation inserts and sheet metal sleeves.

1. Apply two coats of manufacturer's approved exterior sealer finish to flexible unicellular insulation in outside locations.

2. Insulate flanges, valve bodies, and fittings in accordance with manufacturer's published instructions.

C. Urethane insulation:

Apply urethane insulation to underground piping in same manner as fiberglass. Additionally, wrap insulation with 20 mil PVC jacket, solvent weld all seams and joints.

3.03 DUCTS, PLENUMS AND CASINGS INSULATION

A. Rigid Insulation: Secure rigid insulation by impaling over pins or anchors located not more than 3" from edge of boards and spaced not more than 15" on centers and secured with washers and clips. Spot weld anchor pins or attach with a waterproof adhesive especially designed for use on metal surfaces. Apply insulation with joints tightly butted. Neatly bevel insulation around nameplates and access plates and load. Protruding ends of pins shall be cut off flush after clips are secured and sealed with coating compound.

B. Flexible Blanket Insulation: Apply insulation with all joints tightly butted. Insulation on the sides and bottoms of rectangular, horizontal, and sloping ducts shall be secured to ducts by impaling over anchor pins located not more than 3" from the edge and spaced not more than 15" on centers, secured with washers and clips. Anchor pins shall be spot welded or attached with a waterproof adhesive especially designed for use on metal surfaces. Sagging of flexible duct insulation will not be permitted. Protruding ends of pins shall be cut off flush after clips are secured and sealed with coating compound. Stapled seams shall be rotated such that seams are not exposed to view. Provide aluminum tape, minimum 2" wide, at all seams and joints.

C. Insulation Finishes: A skilled mechanic will cut and fit all fittings with flexible insulation for a neat appearance and full coverage with a minimum of unnecessary overlaps. All breaks, punctures, and voids on exposed insulation shall be filled with vapor barrier metal tape. All joints shall be vapor barrier sealed by applying an approved pressure sensitive aluminum tape. All longitudinal and circumferential seams shall be sealed.

D. Access Plates and Doors: On acoustically lined ducts, plenums, and casings, bevel insulation around access plates and doors. Seal exposed insulation at beveled cuts with approved material. On externally insulated ducts, plenums, and casings, provide insulation filled hollow steel panels and doors for access openings.

E. Lined Ductwork: Except as otherwise indicated, omit insulation on ductwork where internally insulated or on cooling terminal units with 1" fiberglass or more internal sound absorbing linings. Refer to "Low Pressure Ductwork" (Division 15700).

F. Ductwork Exposed to Weather: Protect outdoor insulation from weather by installing outdoor protective finish aluminum jacketing as recommended by manufacturer, or as indicated on drawings.

3.04 PROTECTION AND REPLACEMENT

A. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

B. Protection: Insulation installer shall advise contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

C. Hangers and Anchors: Pipe insulation shall be continuous through pipe hangers. Where pipe is supported by the insulation, galvanized sheet metal shields or saddles shall be provided. Where shields are used on pipes 2" and larger, insulation inserts shall be provided at points of hangers and supports. Insulation inserts shall be of cellular glass (minimum 8 pcf), molded mineral fiber (minimum 8 pcf), or other approved material of the same thickness as adjacent insulation. Inserts shall have sufficient compressive strength to adequately support the pipe without compressing the inserts to a thickness less than the adjacent insulation. Insulation inserts shall cover the bottom half of the pipe circumference 180 degrees and be not less in length than the protection shield. Vapor barrier facing of the insert shall be of the same material as the facing on the adjacent insulation. Seal inserts into the insulation with vapor barrier coating. Where protection saddles are used, fill all voids with the same insulation material as used on the adjacent pipe.

D. Sleeves and Wall Chases: Where penetrating interior walls, extend a 24 gauge metal overlapping jacket 3" out on either side of the wall and secure on each end with a metal band. Where penetrating floors, extend a metal jacket from a point below the riser clamp, if applicable, to a point 4" below the floor with one band below at the ceiling and one not more than one inch from end of metal jacket. Seal between metal jacket and galvanized sleeve at floor and wall penetrations with approved fire stop sealant. Vapor seal all insulation and jackets within sleeve similar to that of adjoining insulation.

E. Flanges, Unions, Valves and Fittings (Except Flexible Unicellular): When segments of insulation are used, provide elbows with not less than three segments. For other fittings and valves, cut segments to required curvature, or use nesting size section insulation. Place and join the segments of the insulation adhesive. After the segments are in place, vapor barrier coating as applicable. Where larger valves are to be insulated, utilize removable sections, terminate the covering neatly at the ends with insulation cement troweled on a bevel. Apply a vapor barrier coating, as applicable, to the beveled ends. Cover flanged valve bonnets with removable sections of insulation vapor barrier sealed inside and out with adjacent insulation ends neatly finished and vapor barrier sealed.

1. Fitting and Valve Insulation Vapor Barrier: Outer surfaces of the insulation shall be vapor sealed as follows:

   A minimum wet film thickness of 1/16" coating of vapor barrier compound shall be applied. A single layer of open weave glass fabric 20" x 20" mesh shall be embedded into the wet coat. The fabric shall be drawn smooth and tight with a 2" overlap at all joints. When the first coat is dry, a final coat of vapor barrier compound of 1/16" minimum wet film thickness shall be applied. For temperatures above 35 degrees F, one piece pre-molded fittings and valve covers made of polyvinyl chloride (PVC) with cellular glass precut insulation inserts may be used. Covers shall overlap adjoining pipe covering and vapor barrier jackets.

END OF SECTION

SECTION 15505 - SPLIT SYSTEM / RTU AIR CONDITIONING UNITS

PART 1 - GENERAL

1.01 SCOPE

A. Provide split system air conditioning units of capacities and quantities indicated including air cooled condensers, direct expansion evaporator coils, air units, heating sections and filters.

1.02 RELATED WORK

A. Section 15060 - Pipe, Fittings and Joining Procedures.

Section 15070 - Piping Schedule.

B. General - Bidding and/or negotiations requirements, general conditions of the contract, supplementary conditions, pertinent portions of sections in Division 1 of the project specifications and the drawings shall apply to the work of this section.

1.03 QUALITY ASSURANCE

A. Comply with UL, NEC, AGA, ASME AND NEMA requirements.

1.04 SUBMITTALS

A. Comply with Section 15030. Submit manufacturer's literature showing capacity, physical dimensions, electrical requirements, sound ratings, weight, plan mark number and location of each unit scheduled.

PART 2 - PRODUCTS

2.01 CONDENSING UNITS (CU)

A. See schedule on drawings.

2.02 EVAPORATOR COIL/FAN

A. Evaporator Coil

Configured aluminum fin surface shall be mechanically bonded to 3/8" internally enhanced copper tubing and factory pressure and leak tested at 375 psig. Coil is arranged for draw-through airflow and shall provide condensate drain pan constructed of PVC plastic and provide external connections on either side of the unit.

B. Gas Furnaces

See schedule on drawings

PART 3 - EXECUTION

3.01 INSTALLATION OF CONDENSING UNITS

A. Units to be installed on concrete pads or other structural support as shown on drawings. Provide clearance for maintenance and removal of compressors, motors, etc.

B. Install in manner to prevent condenser discharge air from recirculating to condenser inlet.

3.02 INSTALLATION OF AIR HANDLING UNITS

A. Units to be installed on housekeeping pads, return air platforms or other structural support as shown on drawings. Provide clearance for maintenance of all motors, controls, and coils.

B. Pipe condensate drains to hub drain, floor drain or other drain provided.

END OF SECTION

15550 - ELECTRIC HEATING EQUIPMENT

PART 1 - GENERAL

1.01 SCOPE

A. This section includes specifications for electric unit heaters.

B. Electric heating equipment shall be of size and quantities scheduled on drawings.

1.02 RELATED WORK

A. General: Bidding and/or negotiations requirements, general conditions of the contract, supplementary conditions, pertinent portions of sections in Division 1 of the project specifications and the drawings shall apply to the work of this section.

B. Power wiring to electric heaters to be provided under Division 16.

1.03 QUALITY ASSURANCE

A. Comply with NFPA 90A, NEMA, UL, and SMACNA requirements for manufacture and installation.

1.04 SUBMITTALS

A. Submittals shall comply with requirements of Section 15030. Data shall include capacity ratings, finish, electrical requirements and installation instructions for each item required.

PART 2 – PRODUCTS

2.01 ELECTRIC UNIT HEATERS (EUH)

A. Heaters equal to Emerson-Chromalox type MUH for horizontal/vertical installation shall be provided. Other acceptable manufacturers are Federal Pacific and Trane.

B. Heaters shall be draw-thru air flow with automatic thermal over-heat protection, sub-divided circuits of 48 amps or less, discharge louvers, and mounting brackets.

C. Heaters 7.5KW and larger shall have control transformer and remote thermostat. Smaller than 7.5KW shall have integral thermostat.

.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install heating terminal units as indicated, in accordance with equipment manufacturer's written instructions, and with recognized industry practices, to ensure that heating terminal equipment fulfills requirements. Comply with applicable installation requirements of NEC and NECA's "Standard of Installation".

B. Coordinate with other electrical work, including wiring/cabling work, as necessary to properly interface installation of heating terminal units with other work. Clean dust and debris from each heating terminal as it is installed to ensure cleanliness. Comb out damaged fins where bent or crushed before covering elements with enclosures. Touch-up scratched or marred heating terminal enclosure surfaces to match original finishes.

END OF SECTION

15650 - EXHAUST FANS AND GRAVITY VENTILATORS

PART 1 - GENERAL

1.01 SCOPE

A. Provide roof mounted power exhausters, in-line exhaust fans, wall exhaust fans, roof mount gravity ventilators and outdoor air intakes.

1.02 RELATED DOCUMENTS

A. General: Bidding and/or negotiations requirements, general conditions of the contract, supplementary conditions, pertinent portions of sections in Division 1 of the project specifications and the drawings shall apply to the work of this section.

B. Section 15700 - Sheet Metal Ductwork

Section 15900 - Testing, Adjusting and Balancing

1.03 SUBMITTALS

A. Submittals shall comply with requirements of Section 15030. Data shall include dimension drawings, unit weight, capacity, electrical requirements, sound ratings and curb information.

PART 2 - PRODUCTS

2.01 CEILING MOUNTED FANS (EF)

A. Provide ceiling mounted fans with integral exhaust grille, disconnect switch, discharge duct connection and wall cap.

A. Fans shall be Greenheck SP, Cook Gemini or equal.

2.03 GRAVITY VENTILATORS/FRESH AIR INTAKES (GV AND FAI)

A. Provide low silhouette exhaust relief hood or air intake hood of aluminum construction. Units to have bird screen, back draft damper, hinged hood for access to damper and filters.

B. Hoods to be Cook or Penn.

2.04 PREFABRICATED ROOF CURBS

A. Curbs shall be heavy gauge galvanized steel construction with continuous welded and mitered corner seams, integral base plate, wood nailer, 1-1/2" thick 3 pound density insulation.

B. Curbs shall be 14" high and shall match pitch of roof where installed.

C. Curbs shall be furnished by fan manufacturers.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install exhaust fans, gravity ventilators and outside air intakes in accordance with manufacturer's recommendations. Roof mounted fans shall be securely fastened to roof curbs.

B. Coordinate roof curb installation with steel framing contractor and roofing contractor. Provide burglar bars where indicated on plans. Insure that proper openings are provided for ductwork.

END OF SECTION

15710 - DUCTWORK ACCESSORIES

PART 1 - GENERAL

1.01 SCOPE

A. Ductwork accessories needed for complete duct installation as follows:

1. Manual volume dampers
2. Control dampers
3. Fire dampers
4. Smoke dampers
5. Combination fire and smoke dampers
6. Turning vanes
7. Access doors
8. Flexible duct and accessories
9. Flexible connectors
10. Duct taps and air scoops

1.02 RELATED WORK

A. The following sections contain work related to this section.

15700 - Sheet Metal Ductwork

15900 - Testing, Adjusting and Balancing

B. General: Bidding and/or negotiations requirements, general conditions of the contract, supplementary conditions, pertinent portions of sections in Division 1 of the project specifications and the drawings shall apply to the work of this section.

1.03 QUALITY ASSURANCE

A. Comply with SMACNA Standards "HVAC Duct Construction Standards, 1985".

B. Comply with ASHRAE, NFPA, UL, ASTM and AMCA Standards.

1.04 SUBMITTALS

A. Comply with Section 15030 and submit individual accessory item required for project.

PART 2 - PRODUCTS

2.01 VOLUME CONTROL DAMPERS (MANUAL) - MVD

A. Dampers shall be single blade butterfly type in ducts up to and including 12" x 12" size; for ducts larger than 12" x 12", in either or both dimensions, the dampers shall be the multi-blade type. All dampers in O.A. ductwork shall shut tightly and have vinyl seals and stainless steel jamb seals.

B. Single blade butterfly dampers shall be constructed of not less than 16 gauge galvanized steel blade mounted in a galvanized steel frame. For rectangular dampers, the top and bottom edges of the blade shall be crimped to stiffen the blade. Damper shall be provided with an extended rod to permit installation of a damper regulator.

C. Dampers larger than 12" in either direction shall be multi-blade dampers and shall be opposed blade type, constructed of not less than 16 gauge galvanized steel blade mounted in galvanized steel channel frame. Blade spacing shall not exceed 6" and the top and bottom edges shall be crimped to stiffen the blades. Damper blades shall be interconnected by rods and linkages to provide with an extended rod to permit installation of a damper regulator. Dampers equal to Ruskin CD-35 with blade and jamb seals.

2.02 HARDWARE FOR MANUAL DAMPERS

A. Duct mounted regulators with operating handle and locking quadrant shall be provided on manual volume control dampers. Quadrant shaft shall extend beyond duct external insulation, if applicable.

B. Damper hardware shall be Young Regulator, Duro-Dyne or equal.

2.03 VOLUME CONTROL DAMPERS (AUTOMATIC) - AVD

A. Automatic volume control dampers shall be provided under Section 15800, Automatic Temperature Controls. Installation shall be by sheet metal contractor and shall follow installation procedure specified elsewhere in this section.

2.04 FIRE DAMPERS - FD

A. Provide fire dampers of sizes required for all penetrations or rated assemblies with galvanized steel frame with integral wall mounting sleeve.

B. Dampers shall have rating equal to or greater than rating of wall or floor in which they are installed. Blade assembly shall be curtain type, 100 per cent free opening with no part of blade stack or damper frame located in air stream. Dampers shall be Ruskin IBD-20 or equal.

2.05 SMOKE DAMPERS - SMD

A. Provide UL555S classified smoke dampers where indicated on drawings.

B. Dampers shall be constructed with 120 volt, spring return operator mounted outside of air stream. Dampers shall be Ruskin SD-360 or equal with leakage Class 2.

2.06 COMBINATION FIRE AND SMOKE DAMPERS - F/SMD

A. Provide UL555S classified combination fire and smoke dampers where indicated on drawings.

B. Dampers shall be constructed of galvanized steel frame to function as wall sleeve, contain 165' fusible link and 120 volt motor operator. Damper motor shall be mounted outside air stream.

2.07 TURNING VANES

A. Provide shop fabricated or manufactured turning vanes where indicated on drawings.

B. Turning vanes shall be constructed of 1-1/2" wide curved blades set at 3/4" on center and supported with bars perpendicular to blades. Bars to be set at 2" on center. Set vanes in side strips suitable for mounting in ductwork.

2.08 ACCESS DOORS - AD

A. Provide access door upstream of each MVD, AVD, SMD, F/SMD, smoke detector, duct mounted coil, or where indicated on drawings.

B. Access door shall be of same or greater gauge than ductwork where installed, shall have hinged door, handle type latch, insulated for doors installed in insulated duct and be Ruskin ADH-22 or equal with double skin.

2.09 FLEXIBLE DUCTWORK

A. Provide flexible ductwork at grille connections, length not to exceed 6 feet.

B. Flexible ductwork shall be Class 1, UL 181 approved air duct with polyester inner liner, laminated to a corrosion resistant wire helix, 1" mineral fiber insulation encased with moisture barrier outer jacket. Flexible ductwork to be Genflex SLS-181 or equal.

C. Aluminum helix duct is not acceptable.

2.10 FLEXIBLE CONNECTORS

A. Provide flexible duct connections wherever supply or return ductwork connects to vibrating equipment or as indicated on the drawings.

B. Flexible duct material shall be neoprene coated flameproof fabric crimped into duct flanges for attachment to equipment. Flexible connection must be of adequate flexibility to allow for thermal, axial, transverse, and torsional movement of equipment. Fabric shall be equal to Ventfabrics, Inc.

2.11 DUCT TAPS AND AIR SCOOPS

A. Provide round duct taps at rectangular ducts using Rainaire flanged and gasketed air tight tap, #84ATSD.

B. Taps shall be provided with self-adhering gasket, air scoop and volume damper.

C. Spin-in type taps will be accepted only when provided with air scoop properly positioned in duct tap, manual volume damper and sealed with Hardcast sealant at tap.

PART 3 - EXECUTION

3.01 INSTALLATION OF DAMPERS

A. Assemble multiple section dampers with interconnecting linkage and extend required numbers of shafts through duct for external operation.

B. Install dampers for free movement inside air stream and without damage to internal duct insulation.

3.02 INSTALLATION OF TURNING VANES

A. Secure turning vanes to inside of elbows and offsets with no damage to internal duct insulation.

3.03 INSTALLATION OF ACCESS DOORS

A. Coordinate location of access doors to be accessible above ceilings. Avoid interference with sprinkler piping, plumbing piping and electrical conduits.

B. Access doors to be installed to provide air-tight installation.

3.04 INSTALLATION OF FLEXIBLE DUCT

A. Secure flexible duct to galvanized metal duct or air outlet device using adhesive and nylon straps.

B. Install duct in fully extended condition with no sags or kinks and supported on 36" centers with 1" wide metal strips.

3.05 INSTALLATION OF FLEXIBLE CONNECTORS

A. Provide duct supports on each side of flexible connections.

B. Install flexible connections after equipment to be attached to has been set in place, properly supported and all piping connected. Seal any air leakage at these connections.

3.06 INSTALLATION OF DUCT TAPS

A. Clean duct surface thoroughly. Cut proper size hole in duct where tap is to be made. Place tap with adhesive covered gasket material against duct to align with hole. Secure with sheet metal screws. Check location of air scoop and operation of damper.

B. Extend damper operator to exterior of duct insulation.

END OF SECTION

15720 - AIR DISTRIBUTION DEVICES

PART 1 - GENERAL

1.01 SCOPE

A. Provide air distribution devices as indicated by drawings and schedules.

B. The following type air distribution devices are covered in this section:

1. Ceiling diffusers
2. Sidewall registers and grilles
3. Exhaust grilles
4. Return air grilles
5. Louvers

1.02 RELATED WORK

A. The following sections contain work related to this section:

15250 - Mechanical Insulation

15700 - Sheet Metal Ductwork

15710 - Ductwork Accessories

15900 - Testing, Adjusting and Balancing

B. General: Bidding and/or negotiations requirements, general conditions of the contract, supplementary conditions, pertinent portions of sections in Division 1 of the project specifications and the drawings shall apply to the work of this section.

1.03 QUALITY ASSURANCE

A. Comply with ASHRAE 70 "Method for Testing for Rating the Air Flow Performance of Outlets and Inlets".

B. Comply with AMCA, NFPA and SMACNA requirements. Provide devices which bear the ADC Certified Rating Seal.

1.04 SUBMITTALS

A. Comply with Section 15030.

B. Submittal shall include performance data for each type air device and schedule of air devices indicating drawing symbol, room location, quantity to be furnished, model number, size and accessories to be provided.

PART 2 - PRODUCTS

2.01 CEILING DIFFUSERS - CD

A. Provide manufacturers standard extruded aluminum, standard air ceiling diffuser; verify diffuser is suitable for ceiling in which it is installed. Acceptable manufacturers are Krueger, Price, and Carnes.

B. Provide ceiling diffusers in sizes, blow arrangement and quantities and duct connections shown and in accordance with the following schedule:

CD-1 - Square face, removable core of square concentric louvers, off-white enamel finish (unless noted otherwise), equalizing grid, round duct connection. Equal to Titus TDCA.

CD-2 – Single or multiple slot diffuser, 180 degrees adjustable air pattern, insulated air inlet plenum with duct connection , equal to Titus ML Series.

CD-3 Linear bar grille with mitered corners, ½” border frame, equal to Titus CT-PP-3.

2.02 SIDEWALL REGISTERS - SWR

A. Provide manufacturers standard extruded aluminum sidewall register with border styles compatible with wall system in which register is to be installed.

B. Provide sidewall registers in sizes and quantities shown on drawings and in accordance with the following schedule:

SWR-1 - Double reflection, multi-shutter opposed blade damper, equal to Titus 300 FL.

SWR-2 - Same as above except include air extractor equal to Titus AG-225.

SWR-3 - Linear bar grille complete with mitered corners, 1/2" border frame, equal to Titus CT-PP-3.

2.03 EXHAUST GRILLES - EG

A. Provide manufacturers standard extruded aluminum exhaust grille compatible with wall or ceiling in which grille is to be installed.

B. Provide exhaust grilles in sizes and quantities shown on the drawings and in accordance with the following schedule:

EG-1 - Parallel blade, 1/2" spacing, 35 degrees deflection mounted horizontally for installation in walls or ceilings made of gypboard. Equal to Titus 355 RL.

EG-2 - Same as above, for installation in T-bar ceiling.

EG-3 - Cube core type exhaust grille for installation in walls or ceilings made of gypboard, equal to Titus 50 F.

EG-4 - Same as EG-3 except for installation in T-bar ceiling.

2.04 RETURN AIR GRILLES - RAG

A. Provide manufacturers standard extruded aluminum return air grille compatible with wall or ceiling in which grille is to be installed.

B. Provide return air grilles in sizes and quantities shown on the drawings and in accordance with the following schedule:

RAG-1 - Parallel blade, 1/2" spacing, 35 degrees deflection mounted horizontally for installation in walls or ceilings made of gypboard. Equal to Titus 355 FL.

RAG-2 - Parallel, curved, 45 degrees deflection mounted horizontally for installation in T-bar ceilings. Equal to Titus 23 RL.

RAG-3 - Cube core type exhaust grille for installation in walls or ceilings made of gypboard, equal to Titus 50 F.

RAG-4 - Same as RAG-3 except for installation in T-bar ceiling.

RAG-5 - Double flange door or transfer type grille to fit door or wall thickness required, equal to Titus CT-700.

RAG-6 - Linear bar grille complete with mitered corners, 1/2" border frame, equal to Titus CT-PP-3.

RAG-7 - Bar return grille, heavy duty, 1/2" spacing, 35 degrees deflection. Equal to Titus 38 RL.

2.05 LOUVERS - LV

A. Provide extruded aluminum louvers to fit wall opening, thickness and to be compatible with wall material in which louver is to be installed.

B. Louvers shall be flanged frame with 45 degrees stationary blades with overlap and return bends to maintain weatherproof installation. Provide with factory installed bird screen. Louvers shall be equal to LV-1 American Warming LE-23.

PART 3 - EXECUTION

3.01 INSTALLATION OF GRILLES, REGISTERS AND DIFFUSERS

A. Install air outlets, in accordance with manufacturers recommendations.

B. Coordinate outlet locations with sprinkler, lighting, speaker, and other installations. Locate lay-in ceiling outlets in center of ceiling grid panel.

3.02 INSTALLATION OF LOUVERS

A. Insure that opening sizes are as required for louver specified.

B. Provide caulking or other waterproofing methods as required for weatherproof installation.

END OF SECTION

15800 - TEMPERATURE CONTROLS BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.01 SCOPE

A. This section defines the minimum equipment and performance requirements for pneumatic, electric and electronic system of automatic temperature control.

B. Materials and equipment used shall be manufactured by Honeywell or Siemens.

C. Provide electrical wiring for automatic temperature controls including interlock wiring for fire alarms, building automation system, smoke detection shut-down of A/C units, burglar alarms, pumps, air unit and other interlocks required for operation of controls in accordance with the sequence of operation. All wiring to be in accordance with Division 16 of these specifications, the National Electrical Code and local code authorities.

D. Calibrate, adjust, test and set all control components, operate all systems and demonstrate proper operation of system prior to final inspection of the project.

E. Provide pneumatic piping, air supply, air drier as required.

1.02 RELATED WORK

A. Power wiring to motors, damper operators, smoke detectors, disconnects in excess of 30 volts shall be by Division 16.

B. Mounting of motorized dampers shall be by Section 15800.

C. Installation of automatic control valves shall be by Section 15510.

D. Control Sequence - Section 15850.

1.03 SUBMITTALS

A. Comply with Section 15030. Submit electrical wiring diagrams showing terminal to terminal connection of system components, schematic ladder diagram of system and manufacturer's literature on all components to be furnished.

B. Submit performance data on air compressor, air drier and other pneumatic components. Provide one time piping diagram of pneumatic system.

C. Submit written sequence of operation with diagrams.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Materials and equipment provided shall be of one (1) manufacturer and shall be one (1) of the following:

Honeywell or Siemens

2.02 MATERIALS AND EQUIPMENT

A. Provide control products in sizes and capacities indicated consisting of valves, dampers, thermostats, sensors, controllers, and other components as required for complete installation. Except as otherwise indicated, provide manufacturer's standard control system components as indicated by published product information, designed and constructed as recommended by manufacturer.

B. Control Valves: Provide factory fabricated control valves for type, body material and pressure class indicated. Where type or body material is not indicated, provide selection as determined by manufacturer for installation requirements and pressure class, based on maximum pressure and temperature rating of piping system. Except as otherwise indicated, provide valves which mate and match material of connecting piping. Equip control valves with control valve operators, and with proper shutoff ratings for each individual application.

C. Dampers: Provide automatic control dampers as indicated, with damper frames not less than formed 13 gauge galvanized steel. Provide mounting holes for enclosed duct mounting. Provide damper blades not less than formed 16 gauge galvanized steel, with maximum blade width of 8". Equip dampers with operators, with proper rating for each application. Damper shall be Ruskin RCD-45.

1. For standard applications as indicated, provide parallel or opposed blade design (as selected by manufacturer's sizing techniques) with optional closed-cell neoprene edging.

2. For low-leakage applications as indicated, provide parallel or opposed blade design (as selected by manufacturer's sizing techniques with inflatable seal blade edging, or replaceable rubber seals, rated for leakage at less than 10 cfm/sq. ft. of damper area, at differential pressure of 4" w.g. when damper is being held by torque of 50 inch-pounds.

D. Firestats shall be manual reset limit switch set at 125 degrees F., mounted in return air stream. Equal to Honeywell L4029E.

E. Smoke detectors shall be ionization or photoelectric type with factory manufactured housings and sampling tubes and shall operate in the range of 300 fpm to 3000 fpm. Smoke detectors shall have indicating lights which show normal and alarm modes and shall be provided with remote reset switches with same indications.

F. Water Flow Switches: Provide water flow switches of stainless steel or bronze paddle types. Where flow switches are used in chilled water applications, provide vapor proof type to prevent condensation of electrical switch. Provide pressure flow switches of bellows actuated mercury type or snap acting type, with appropriate scale range and differential adjustment for service indicated.

G. Thermostats or room sensors shall be furnished with HVAC units.

H. Single and multi-colored low voltage and power limited electrical wire and cables placed in air conditioning plenums or plenum chambers or other spaces used for environmental air handling purposes shall meet all standards of HL910 and have a peak optical density not greater than 0.15 and a flame spread of 5 feet or less and shall be classified as having adequate fire resistance and low smoke producing characteristics.

I. Programmable Building Automation System (BAS) to monitor and control each HVAC system. Provide remote monitoring of each system for air unit status (on/off), space temperature, and return air temperature. Provide time-of-day, day-of-week scheduling for each system and manual over-ride.

<u>PART 3 - EXECUTION</u>

3.01 INSTALLATION OF CONTROL MATERIALS AND EQUIPMENT

A. Install systems and materials in accordance with manufacturer's instructions and rough-in drawings, and details on drawings. Install electrical components and use electrical products complying with requirements of applicable Division 16 sections of these specifications. Mount controllers at convenient locations and heights. Insure that proper openings are provided for ductwork.

B. Unit-Mounted Equipment: Where control devices are indicated to be unit-mounted, ship electric relays, electric switches, valves, dampers, and damper motors to unit manufacturer for mounting and wiring at factory.

C. Mount thermostats and room sensors 60" A.F.F. unless otherwise noted.

3.02 INSTALLATION OF WIRING FOR CONTROLS

A. Install complete control wiring system for electric control systems. Conceal wiring, except in mechanical rooms and areas where other conduit and piping is exposed. Provide multi-conductor instrument harness (bundle) in place of single conductors where number of conductors can be run along common path. Fasten flexible conductors bridging cabinets and doors, neatly along hinge side, and protect against abrasion. Tie and support conductors neatly.

1. All wiring above 24 volt will be in conduit.

2. Conduit for 24 VAC or lower will be in accordance with local codes.

3. Wiring exposed to outdoor elements will be in rigid conduits.

B. Number-code or color-code conductors appropriately for future identification and servicing of control system.

C. Conduit and wiring shall not be run concealed inside ducts or under duct insulation.

END OF SECTION

15900 - TESTING, ADJUSTING AND BALANCING

PART 1 - GENERAL

1.01 SCOPE

A. Extent of testing, adjusting and balancing work is indicated by requirements of this section, and also by drawings and schedules, and is defined to include, but is not necessarily limited to, air distribution system, hydronic piping systems, and associated equipment and apparatus of mechanical work.

B. The work consists of setting speed and volume (flow) adjusting facilities provided for systems, recording data, conducting tests, preparing and submitting reports, and recommending modifications to work as required by contract documents.

C. Component types of testing, adjusting and balancing specified in this section includes fans, air-conditioning units, ductwork systems, air outlets and inlets, pumps, coils, compressors and heating units.

1.02 QUALITY ASSURANCE

A. Comply with American Society of Heating, Refrigerating, and Air Conditioning Engineers, Inc. (ASHRAE), National Environmental Balancing Bureau (NEBB), or Associated Air Balance Councils (AABC) recommendations pertaining to measure, instruments, and testing, adjusting and balancing.

B. Do not proceed with testing, adjusting and balancing work until work has been completed and is operable.

C. Do not proceed until work scheduled for testing, adjusting and balancing is clean free from debris, dirt and discarded building materials.

1.03 SUBMITTALS

A. Comply with Section 15030. Submit certified test report signed by test and balance supervisor who performed TAB work. Include identification and types of instruments used and their most recent calibration data with submission of final test report.

PART 2 - PRODUCTS

2.01 PATCHING MATERIALS

A. Except as otherwise indicated, use same products as used by original installer for patching holes in insulation, ductwork and housing which have been cut or drilled for test purposes, including access for test instruments, attaching jigs, and similar purposed. At tester's option, plastic plugs with retainers may be used to patch drilled holes in ductwork and housings. Do not leave test holes uncovered.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine installed work and conditions under which testing, is to be done to ensure that work has been completed, cleaned and is operable. Do not proceed with TAB work until unsatisfactory conditions have been corrected in manner acceptable to tester. contractor and roofing contractor. Insure that proper openings are provided for ductwork.

B. Coordinate installation of dampers, balance valves, test ports, etc. with installer to insure adequate test and balance devices are installed to perform work properly.

3.03 TESTING, ADJUSTING AND BALANCING

A. Test, adjust and balance environmental systems and components, as indicated, in accordance with procedures outlined in applicable standards.

B. Air Balance: The air balance shall include the following air tests in accordance with the following requirements:

1. Test and adjust blower RPM or vane setting to design requirements (within +/- 5% of design requirements).

2. Test and record motor full load amperes and voltages on all phases.

3. Make pitot tube traverse of main supply ducts and obtain design cfm at fans.

4. Test and record system static pressure.

5. Test and adjust system for design recirculated air cfm.

6. Test and adjust outside system for design cfm outside air.

7. Test and adjust exhaust air system for design cfm.

8. Test and record entering air temperatures of heating and cooling coils (both db and wb of cooling coils).

9. Test and record leaving air temperatures of heating and cooling coils (both db and wb of cooling coils).

10. Adjust all main supply and return air ducts to proper design cfm.

11. Adjust all zones to proper design cfm, supply and return.

12. Test and adjust each outlet and inlet (diffuser, grille and register) to within +/- 10% of design requirements. Use proportional method of balancing.

13. Size and location of diffusers, grilles, registers, and tested equipment shall be identified and listed. Manufacturer's ratings on all equipment shall be used to make required calculations.

14. Readings and tests of diffusers, grilles, and registers shall include required cfm and test resultant cfm after adjustments.

15. In cooperation with the control manufacturer's representative, setting adjustments of automatically operated dampers to operate as specified, indicated and/or noted.

16. Prepare reports of test results, including instrumentation calibration reports, in format recommended by applicable standards.

17. Mark equipment setting, including damper control positions, valve indicators, fan speed control levers, and similar controls and devices, to show final settings at completion of TAB work. Provide markings with paint or other suitable permanent identification materials.

END OF SECTION

SECTION 16010 - GENERAL PROVISIONS

PART 1 - GENERAL

1.O1 RELATED DOCUMENTS: This section supplements all sections of this Division and shall apply to all phases of work specified herein, shown on the drawings, or required to provide a complete installation of electrical systems.

1.02 DESCRIPTION OF WORK:

A. SPECIFICATIONS AND DRAWINGS: Shall be complementary and be used for the complete interpretation of the electrical work.

1. Unless noted or modified by specific notation to the contrary, the indication and/or description of any electrical item in the documents carries with it in the instruction to furnish, install and connect same. It shall be understood that the intent governs the work, regardless of whether or not this instruction is explicitly stated.

2. No exclusion from or limitation in drawings or specifications for the electrical work shall be reason for omitting the appurtenances, accessories, or devices necessary to complete any required system or item of equipment or compliance with codes.

3. The drawings are shown in part diagrammatic, intended to convey the scope of work, indicating the general arrangement of equipment, conduit and outlets. Follow the drawings in laying out the work and verify places for the installation of the materials and equipment. Wherever a question exists as to the exact intended location of outlets or equipment, obtain instructions from the Architect and Engineer before proceeding with the work.

B. WORK INCLUDED: Furnish all labor, material, services and skilled supervision necessary for the construction, erection installation, connections, testing and adjustment of all circuits and electrical equipment specified herein, or shown or noted on the drawings, and its delivery to the owner complete in all respects ready for use.

C. COORDINATION OF WORK:

1. Plan all work so that it proceeds with a minimum of interference with other trades. Inform all parties concerned of openings required for equipment or conduit in the building construction for electrical work

and provide all special frames, sleeves and anchor bolts as required. Coordinate the electrical work with the mechanical installation.

2. Work lines and established heights shall be in strict accordance with architectural drawings and specifications insofar as these drawings and specifications extend. Verify all dimensions shown and establish all elevations and detailed dimensions not shown.

3. Lay out and coordinate all work well enough in advance to avoid conflicts or interference's with other work in progress so that in case of interference the electrical layout may be altered to suit the conditions, prior to the installation of any work and without additional cost to the owner. Conflicts arising from lack of coordination shall be this Contractor's responsibility.

D. COOPERATION WITH OTHER TRADES:

1. Perform this work in conformity with the construction called for by other trades and afford reasonable opportunity for the execution of their work. Properly connect and coordinate this work in such a manner as not to delay or interfere with the work of other trades.

2. Examine the drawings and specifications for the general and mechanical work and the work of other similar trades. Coordinate this work accordingly. Provide written confirmation that the electrical requirements for all mechanical equipment have been coordinated with the mechanical contractor.

3. Promptly report to the Architect any delay or difficulties encountered in the installation of this work which might prevent prompt any proper installation, or make it unsuitable to connect with or receive the work of others. Failure to so report shall constitute an acceptance of the work of other trades as being fit and proper for the execution of this work.

1.03 SHOP DRAWINGS, SUBMITTALS AND OPERATING INSTRUCTIONS:

A. GENERAL: Submit all necessary shop drawings and factory literature for Architect/Engineer approval.

1. They shall be approved prior to final fabrication and/or purchase.

2. Shop drawings shall fully explain all procedures involved in executing a complete operational electrical work.

3. Factory literature shall be specific for all factory assembled equipment, fixtures, devices, and items of equipment.

4. All submittals shall properly indicate to the pertinent equipment their external connections for field installation and the necessary field installation instruction.

5. They shall be submitted in the required number of copies and on type of paper in conformance with the GENERAL CONDITIONS.

B. SAMPLES: Submit samples upon request for approval - one of each with proper tag indicating project and intended location and function.

C. OPERATING INSTRUCTIONS: Included in the electrical work is the issuance of operating instructions for all equipment requiring service.

1. Provide qualified personnel for demonstration purposes, the date to be convenient to Architect and Owner.

2. Provide three (3) copies of all pertinent operating and maintenance instructions in 3-hole binder manual.

3. Provide the name, address and telephone number of the manufacturer's local service representative of each item of equipment included in the above requirements.

4. Provide assistance by qualified field personnel for aiding and helping the demonstration personnel.

1.04 AS BUILT RECORD DRAWINGS - ONE LINE DIAGRAM:

A. GENERAL: Electrical Contractor, at completion of job, shall give general contractor one complete set of electrical drawings reflecting all as built conditions.

1. Mount full sized print of store electrical system One-Line Diagram on inside wall of main switchboard room.

1.05 CODES, PERMITS AND FEES:

A. CODES: All work shall meet or exceed all legal requirements and the latest requirements of the National Electric Code, and all State, County, Municipal and other authorities having jurisdiction over electrical construction work at the project.

1. Comply with all applicable building ordinances and codes. Where the contract documents exceed minimum requirements, the contract documents take precedence.

B. PERMITS AND FEES: Comply with all requirements for permits, licenses, fees and codes. Permits, licenses, fees and arrangements required for the work under this contract shall be obtained by the Contractor at his expense, and made available at the completion of the work, unless otherwise specified.

1. Comply with the requirements of the applicable utility companies serving this project. Make all arrangements with the utility companies for proper coordination of the work.

1.06 MATERIALS AND EQUIPMENT FURNISHED BY OWNER:

A. CONTRACTOR: The electrical work includes the installation or connection of certain materials and equipment furnished by the owner. The Electrical Contractor shall do the following:

1. Coordinate all their delivery and security.

2. Unload from arriving delivery vehicles on any designated area on the job site.

3. Handle and store on field storage area until the time of permanent placement.

4. Provide field make-up and internal wiring necessary for their intended operation.

5. Mount in place and provide supporting members and fastening necessary to accommodate specific loading requirements.

6. Examine all items for all damages incurred during delivery for claims to repairing and/or replacing same.

7. Foundations for apparatus and equipment will be furnished by others, unless otherwise noted or detailed.

PART 2 - PRODUCTS

2.01 EQUIPMENT AND MATERIALS:

A. GENERAL:

1. Equipment and fixtures shall be connected providing circuit continuity in accordance with applicable codes whether or not each conductor, conduit, or protective device is shown between such items of equipment or fixtures, and the point of circuit origin.

2. Unless otherwise specified, equipment and materials of the same type or classification, and used for the same purpose, shall be products of approved manufacturers.

3. Use only new, unweathered, and unused material, except as specifically noted.

B. APPLICABLE DOCUMENTS: Design, manufacture, testing and method of installation of all apparatus and materials furnished under the requirements of these specifications shall conform to the latest publications of standard rules of the following:

1.	American Institute of Steel Construction	AISC
2.	American Society for Testing and Materials	ASTM
3.	Federal Specifications	FED.SPEC.
4.	Institute of Electrical and Electronic Engineer	IEEE
5.	Insulated Power Cable Engineers Association	IPCEA
6.	National Electrical Code	NEC
7.	National Electrical Manufacturer's Association	NEMA
8.	National Electrical Safety Code	NESC
9.	National Fire Protection Association	NFPA

10.	Occupational Safety and Health Act	OSHA
11.	Underwriters' Laboratories, Inc.	UL
12.	American National Standard Institute	ANSI
13.	International Electrical Counsel	IEC

C. IDENTIFICATION OF EQUIPMENT: Identify individually each piece of equipment with a laminated micarta nameplate black/white core and 1/4" high engraved letters. Temporary identification is required upon installation.

1. Equipment to be labeled.

    a. Switchboards.

    b. Panelboards.

    c. Transformers.

    d. Disconnect Switches (with name of equipment served).

    e. Telephone Cabinets not located in electric panel room.

    f. Emergency System Equipment.

    g. Lighting Control Panels.

    h. Fire Alarm Panels.

2. Do not use abbreviated terms for identification. Spell out in full the proper name and number of each identified equipment, i.e., PANEL-LPA-1 OR AIR HANDLING UNIT - AH 5.

3. Additional labeling of disconnect switches: Each and every disconnect installed by this contractor shall have affixed on front a label, black on safety yellow (5" X 2"), reading: "USE LOCKOUT DEVICE DURING MAINTENANCE OR ANY OPERATOR ADJUSTMENT". Label shall be pressure-sensitive flexible plastic with protective mylar overlay and equal to Seton Name Plate Co. catalog no. SL104.

4. Additional labeling of switchboards, distribution boards, and panelboards: Each and every switchboard, distribution board, and panelboard shall have affixed on front, as detailed below, a label or labels, black on safety yellow (5" X 2"), reading: "LOCKOUT FOR SAFETY". Label shall be pressure-sensitive flexible plastic with protective mylar overlay and equal to Seton Name Plate Co. catalog no. SL101. Switchboards shall have one label affixed to each vertical section of the switchboard at an elevation of approx. 5'-0" AFF. Each distribution board and panelboard and each section thereof shall have one label affixed at an elevation of approx. 5'-0".

2.02 SUBSTITUTION OF MATERIALS AND EQUIPMENT

A. For products specified herein, bids shall be based on products named in project manual and on plans, or on items designated as an "approved equal". A product not named in project manual or on plans will only be acceptable when such product meets all other requirements of project specifications, including specifications of originally specified products' manufacturer as of date of contract documents and request has been made for product substitution.

The first manufacturer listed in these specifications and the manufacturer and catalog number listed in the equipment schedules was used for design, layout, performance, physical size, space and structural requirements, electrical requirements and general appearance. Any equipment selected from the approved alternate list of manufacturers must be compatible with the facility and meet all requirements of the contract documents. Any changes required due to the alternate selected equipment being different from the design basis equipment, shall be the responsibility of the mechanical contractor and he shall pay for any increased costs as a result of these changes.

B. Requests for approval of a product as equal will not be considered unless sufficient data for evaluation is received seven (7) days prior to the bid opening date.

PART 3 - EXECUTION

3.01 GENERAL:

A. EQUIPMENT AND MATERIAL: Install in a neat and workmanlike manner and align, level and adjust for satisfactory operation. Install equipment so that all parts are easily accessible for inspection, operation, maintenance and repair.

1. Where marring or disfigurement has occurred, replace or refinish the damaged surfaces as directed and to the satisfaction of the Architect.

2. Provide the design, fabrication and erection of supplementary structural framing required for attachment of hangers or other devices supporting electrical equipment.

3. Provide framing members of standard rolled steel shapes, A-36 steel. Provide members welded to structural members equal to the specification for the main structural member. Provide "simple beam" type framing with end connections welded or bolted for shear loads. Use cantilevers only when detailed or specifically approved by the Architect. The Architect's approval is required for location of supplementary framing. Use only certified welders.

B. OUTLET LOCATION:

1. Center all outlet boxes with regard to paneling, furring and trim. Repair or replace damaged finishes. Set outlet boxes plumb and extend to the finished surface of the wall, ceiling or floor without projecting beyond same.

2. Install symmetrically all receptacles, switches, and devices shown and where necessary set the long dimension of the plate horizontal or ganged in tandem.

3. More than one device in same location to be grouped under common (multi-toggle) plate.

C. CUTTING, PATCHING AND PIERCING:

1. Obtain written permission of the Architect before cutting or piercing structural members.

2. Use craftsmen skilled in their respective trades for cutting, fitting, repairing, patching of plaster and finishing of materials including carpentry work, metal work or concrete work required for this work. Do not weaken walls, partitions or floors with cutting. Holes required

to be cut in floors must be drilled without excessive breaking out around the holes. Patching and/or refinishing will be determined by the Architect.

3. Sleeves shall be installed flush with finished walls, finished ceilings or finished floors, sized to accommodate the raceway, unless otherwise specified.

4. Roof penetration and repairing shall be done by others.

5. Provide watertight conduit openings through floor slabs, masonry walls and continuous partitions. Tightly caulk space between conduit and building materials non-flammable sealant.

6. Seal equipment or components exposed to the weather and make watertight and insect proof. Protect equipment outlets and conduit openings with temporary plugs or caps at all times that work is not in progress.

D. SPECIAL CONSIDERATIONS:

1. Locate switches, receptacles and pull boxes to provide easy access for operation, repair and maintenance, and, if concealed, provide access doors.

2. Install floor-mounted equipment on 4" concrete housekeeping pad as specified in appropriate sections of this specification.

3. Provide Belleville washers on all bolted connections. Split ring washers are not acceptable.

4. Take such precautions as necessary to properly protect all apparatus, fixtures, appliances, material, equipment and installations from damage of any kind. The Architect may reject any particular piece or pieces of material, apparatus or equipment scratched, dented or otherwise damaged.

5. Prepare all fittings, boxes, supports and panelboards exposed for painting by removing all oil, grease and dirt. Employ the necessary precautionary methods to prevent scratching or defacing of all electrical apparatus and devices.

6. Exposed conduit installed after room has been painted shall be painted to match room finish by this Contractor.

7. Provide hot dip galvanized components for ferrous materials exposed to the weather.

8. The use of roof deck for support of lighting fixtures, conduit, raceways, and other electrical equipment is not permitted. Provide beam clamps, hanger rods, conduit and pipe hangers/supports and straps.

E. NOISE LIMITATION:

1. Perform all work to assure minimal noise produced by the electrical equipment and installation.

2. Check and tighten all plates, covers, doors and trims used in conjunction with electrical equipment.

3. Remove and replace any device or equipment which is found to emit noise level higher than industry standards. Perform all work in accordance with the field instructions issued by the Architect to alleviate such conditions.

4. All equipment requiring tightening and all device, lug and connector terminals shall be tightened to the manufacturer's prescribed torque value.

3.02 TESTS:

A. GENERAL:

1. Perform all tests deemed necessary to establish full conformance with the specifications, their intent, drawings and suitable operation of each system.

2. Before application for final acceptance will be considered, all prescribed tests shall be performed and statement to that effect be submitted, signed by the party responsible for conducting such test and the party responsible witnessing same.

3. Correct promptly all defects and deficiencies discovered in any of the electrical work during testing, and demonstrate compliance to this effect.

3.03 GUARANTEES AND CERTIFICATIONS:

A. GUARANTEES: All work to be guaranteed in conformity with the requirements of the "Guarantee" portion of the GENERAL CONDITIONS.

1. All test results shall be submitted and made part of the final acceptance.

B. CERTIFICATIONS: All certificates required by governing authorities shall be submitted with no reservations attached.

END OF SECTION

SECTION 16110 - RACEWAYS

PART 1 - GENERAL

1.01 WORK INCLUDED: This section covers raceways, fittings, and underfloor ducts, complete.

1.02 WORK SPECIFIED ELSEWHERE:

A. 16120 "Conductors"

B. 16420 "Electrical Service Entrance"

C. 16450 "Grounding"

PART 2 - PRODUCTS

2.01 MATERIALS:

A. RACEWAYS:

1. Rigid conduit shall be hot dipped galvanized steel heavy wall. The conduit shall bear the U.L. label and shall conform to U.L. 6 and ANSI C80.1.

2. Rigid aluminum conduit shall be heavy wall as manufactured by Alcoa, Kaiser, or approved equal.

3. Electrical metallic tubing (EMT) shall be galvanized steel thin wall. The tubing shall bear the U.L. label and shall conform to U.L. 797 and ANSI C80.3.

4. Quick coupling EMT shall only be as manufactured by Triangle PWC (UNI-COUPLE EMT) and Allied (KWIK-FIT EMT).

5. Flexible metallic conduit shall be galvanized steel tape formed into an industry standard interlocking coil as manufactured by Republic, Triangle, or approved equal.

6. Polyvinyl chloride (PVC) conduit shall be heavy wall Schedule 40 as manufactured by Carlon Electrical, Visqueen, or Condux. The conduit shall bear U.L. label and shall conform to U.L. 651.

Schedule 80 PVC where required, by Carlon Electrical, Visqueen or Condux.

7. Electrical nonmetallic tubing (ENT) shall meet requirements of NEMA TC-13 and shall be U.L. listed. Approved manufacturer: Carlon.

8. Intermediate metallic conduit (IMC) shall be galvanized steel. The conduit shall bear the U.L. label and shall conform to U.L. 1242 and ANSI C80.6.

9. Minimum/maximum sizes.

   a . No conduit shall be less than 1/2" trade size. Regardless of wiring no conduit in concrete or masonry shall be less than 3/4".

   b. No conduit shall be larger than 5" trade size.

   c. Utilize factory manufactured elbow 1-1/4" trade size and larger.

   d. Conduit is furred columns shall be 1-1/4" maximum in size.

10. BX is specifically not permitted.

B. CONDUIT FITTINGS:

1. Rigid metal conduit fittings for heavy wall conduit and IMC shall be of the threaded type. No other type of fitting shall be used unless specific approval is given.

2. EMT fittings shall be of the concrete-tight, kwik-fit or rain-tight type as required by location. Indenter type fittings not acceptable. No set screw type fittings permitted on conduits embedded in the floor slabs or buried conduits.

3. Flexible metallic conduit fittings shall be specifically designed for use with same and shall have smooth rounded ends for wire protection.

4. PVC conduit fittings shall be those recommended by the PVC conduit manufacturer.

5. ENT fittings shall be listed by U.L. for concrete tight applications.

Fittings shall be as manufactured by the ENT manufacturer.

6. Special fittings shall be listed or approved equal

a.	Sealing Gland Assembly	OZ, Type FSK
b.	Expansion Joints	OZ, Type AX or TX with bonding jumpers and clamps.
c.	Expansion and Deflection Fittings	OZ, Type DX
d.	Cast Metal Conduit Fittings	Crouse-Hinds, Condulets
e.	Combination Coupling	OZ, Type ETR
f.	Seal Fitting	OZ, Type EYA

7. Beam clamps used to secure conduit support apparatus shall be cast iron type.

PART 3 - EXECUTION

3.01 RACEWAYS:

A. INSTALLATION:

1. All conduits to run concealed, except as follows:

   a. Mechanical and Electrical Equipment Rooms.

   b. Unfinished spaces.

   c. Where indicated on the contract drawings.

2. Make all cuts square with no reduction in trade size and ream out all burrs.

3. Provide expansion fittings for conduits crossing building expansion lines.

4. Cap all conduits with proper fittings until wires are pulled in.

5. All conduits installed in hollow metal, stud and wallboard, any movable or semi-permanent floor to ceiling partition shall originate from ceiling plane. No stub-ups from floor slabs, except for partitions less than floor to ceiling in height.

6. Underground conduits, conduits installed in wet areas, and conduits under grade slab shall be rigid steel painted with Bituminous paint or PVC. (Refer to Section 16450, "Grounding") Conduits installed within reinforced grade level slabs shall be PVC, EMT, ENT, or rigid steel and the maximum size shall be 3/4" trade size. Conduits installed in partial cuts of set grade level slabs shall be PVC, EMT, ENT, or rigid steel.

7. Conduits in or under slabs not on grade shall be EMT, IMC, or rigid steel.

8. Conduits underground for remote facilities services shall be encased in minimum 3" concrete, 3000 PSI. For specific electrical service entrance requirements see specification Section 16420.

9. All conduits penetrating walls or ceiling of the HVAC Fan Room(s) shall be rigid steel and sealed at the conduit joint just prior to entering the fan room(s) to prevent the passage of air. Conduits entering the fan room(s) through the floor shall be rigid steel and sealed at the first conduit joint above the floor. Utilize conduit seal fittings.

10. Seal off all conduits with appropriate fittings penetrating:

    a. Foundation Walls

    b. Hazardous Areas

    c. Roof Seal (See General provision)

    d. Waterproof Deck and/or Wall

11. Conduits in concrete shall conform to the following:

    a. They shall be located below reinforcing material.

b. They shall not displace structural steel.

c. They shall be routed not to cause structural weakness.

d. They shall have a minimum of 1" separation from any surface of the concrete.

e. They shall be routed in accordance with field instructions issued for extenuating conditions by the ARCHITECT. These instructions do not entitle Contractor to extra compensation.

f. No conduit shall be permitted in unreinforced concrete slabs on grade. Conduit in these locations shall be placed in gravel base beneath such slabs unless otherwise noted on the drawings.

12. Exposed conduit shall run straight at right angles and parallel with building lines. This requirement is also applicable to all areas defined as exposed by the NEC, Article 100.

13. All exposed vertical feeder conduits in unfinished areas are to be installed adjacent to permanent non-movable walls. The installation in any other location is not acceptable. (Movable wall is defined as non-masonry.)

14. Stub-ups or sleeves through concrete slab shall be rigid steel and shall extend 12" above finished floor.

15. All equipment requiring motion or noise separation shall be terminated with flexible metallic conduit. All flexible metallic conduit exposed to weather shall be liquid-tight.

16. No aluminum conduit shall be embedded in concrete or earth.

17. Support all conduits with rigidly mounted junction boxes, metal straps, hangers or clamps to provide a rigid installation. All supports to be independent from other equipment and in a manner not to impede the ready removal of other conduits, pipes and structural

supports of other trades.

18. Conduits shall be supported from the structure support members or walls. Supporting from the ceiling grid system hanger wires, T-bars or cross T-members, except as specifically noted herein is not permitted. Penetration of roof deck is not permitted for hangers, clamps, etc.

19. Plenum routed flexible metal conduit and armor cable branch circuits shall be individually secured at code required intervals using ceiling T-bar wire clips or as indicated for conduits above. They shall not lie on the ceiling tiles or grid system.

20. Provide all empty conduits with appropriate pulling cord or wire.

21. All conduits shall be installed in an acceptable workmanlike manner.

22. No conduits may be run on the floor surface or in such a manner as to be hazardous to traffic.

23. For PVC conduit utilize solvent cement joints for all fittings and make all joints watertight. Provide adapters for connections to metal components. Continuous ground wire is required. See Section 16450, Grounding.

24. Metallic conduits only shall be installed in ceiling plenums, hollow walls, furred spaces and column furring.

25. Make all conduit joints tight, no running threads are accepted. If necessary, use ERICKSON type couplings.

26. Provide locknut and bushing for conduit termination. Bushing shall be insulated 1-1/4" trade size and above.

27. All conduits exposed to mechanical injury and in hazardous areas shall be heavy wall.

28. ENT shall only be used encased in concrete in the on grade slab.

    a. Utilize cement labeled for use with ENT for joints for all fittings and make concrete tight per manufacturer instructions.

b. Appropriately secure in place to prevent floating during concrete pour.

29. For metallic raceway and conduits stubbed above ceiling used for communication and other power limited wiring install plastic ring or bushing on end above the ceiling.

END OF SECTION

SECTION 16120 - CONDUCTORS

PART 1 - GENERAL

1.01 WORK DESCRIPTION: This section covers all conductors 600V or less.

1.02 WORK SPECIFIED ELSEWHERE: Raceways, Section 16110.

PART 2 - PRODUCTS

2.01 MATERIAL:

A. GENERAL:

1. All conductors shall have insulation rated 90 degrees C and shall be 98% minimum conductivity soft, properly refined copper, solid, for size 10 AWG and smaller. Size 8 AWG and larger conductors shall be stranded copper. Stranded conductors smaller than 8 AWG are not allowed.

2. Minimum size conductor for power and lighting circuits shall be 12 AWG.

3. Maximum size conductor for feeders and power circuiting shall be 500MCM.

4. BX cable is not permitted.

5. MC cable with solid copper conductors and approved for use fittings is permitted with the following restrictions. MC cable (individual circuit, 3 #12 insulated conductors) may be used for receptacle outlet drops and lighting switch drops in gyp board and stud walls and individual lighting fixture drops. MC cable shall not be run between lighting junction boxes and shall not exceed 8 ft in length from junction box to receptacle, wall switch or light fixture.

6. Conductors for HVAC 120V control wiring shall be size 14 AWG stranded. For low voltage exception refer to HVAC specification Division 15.

B. ALUMINUM CONDUCTORS:

1. Aluminum feeders or branch circuit conductors are not allowed.

C. LOW VOLTAGE WIRE:

1. U.L. listed and approved non-conduit types must be used unless not legally permitted. Use must comply with the following:

2. All signal wire shall meet or exceed applicable portions of specifications in regard to the conductors. The non-conduit cable jacket material description will be substituted for conventional cable jacket description.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION:

A. CONDUCTORS:

1. All conductors shall be continuous from outlet to outlet.

2. Leave sufficient slack on all runs to permit secure connection of equipment.

3. All conductors shall be pulled simultaneously when installed in a common raceway. Delay pulling in until the project progresses to a point where conductors shall not be exposed to injury and moisture.

4. Swab all conduit prior to pulling the conductors and mandrel, with 85% ball, all conduits 2" and larger.

5. Use only specifically manufactured lubricant for wire pulling purposes.

6. Dress and lace wires and cables in all cabinets and pull boxes and use necessary insulated support to prevent shifting.

7. Identify feeders at each pull box and cabinets with permanent non-metallic band or tag.

8. All conductor insulation shall be rated for 600 volt, unless otherwise noted.

9. Utilization of insulation shall be as follows:

a. Lighting and appliance branch circuiting. THHN

b. Main and sub-feeders. THHN

c. Fixture wires. TFN, TFFN, SF, RHH, THHN

d. Direct burial or underground RHW-USE, UF, RR

10. Exterior of wires shall be color coded.

a. Color coding shall clearly indicate the difference between:

(1) Phase wires of different voltage systems.

(2) Neutral and phase wires of each voltage system.

(3) The grounding system wire.

b. Unless required otherwise by local code authorities use the following color coding scheme:

120/208	277/480 Volt System	120/240 System
Phase A - Black	Phase A – Brown	Phase A- Black
Phase B - Red	Phase B – Orange	Phase B - Red
Phase C - Blue	Phase C – Yellow	Phase C – (Wild leg) Orange
Neutral - White	Neutral - Natural Gray	Neutral - White

c. All equipment grounding conductors are to be green in color. All isolated ground conductors are to be green in color with an over-layed black or yellow stripe.

d. In sizes and insulation types where factory applied colors are not available, colored plastic tape in overlapping turns shall be applied at all terminal points and in all points of splicing. Tape shall be applied at a minimum intervals of 6" along the wires and cables.

B. SPLICING AND TERMINATING:

1. Maintain all splices and joints in accessible enclosures, where easy inspection is available.

2. Join solid conductors with expendable type insulated coiled steel spring connections (wire nut), or by twisting and soldering.

3. Terminate solid conductor by means of a neat and fast application directly to the binding screw or post of the equipment.

4. Join, tap and terminate stranded conductors #6 AWG and larger by means of solder sleeves, taps and lugs with applied solder or by means of bolted saddle type or pressure indent type connectors, taps and lugs. Apply pressure indent type connectors, taps and lugs utilizing tools manufactured specifically for the purpose and having features preventing their release until the full pressure has been exerted on the lug or connector.

5. Except where wire nuts are used, build up insulation over conductor joints to a value, equal both in thickness and dielectric strength, to that of the factory applied conductor insulation. Insulation of conductor taps and joints shall be by means of half-lapped layers of rubber tape, with an outer layer of friction tape; by means of half-lapped layers of approved plastic electric insulating tape; or (in the case of bolted type connector joints) by means of split insulating casings molded specifically to insulate the particular connector and conductor, and fastened with stainless steel or non-metallic snaps or clips.

6. Exclude splicing procedures for neutral conductors in lighting and appliance branch circuitry which utilize device terminals as the splicing points.

7. Exclude joints or terminations utilizing solder in any conductors used for grounding or bonding purposes.

8. Exclude all but solder or pressure indent type joints in conductors used for signalling or communications purposes.

3.02 INSTALLATION OF LOW VOLTAGE WIRE:

A. CABLE INSTALLED WITHOUT CONDUIT: Shall not be visible in any area accessible to the public. Cables shall be routed in all areas so as to minimize the chance of accidental mechanical damage during any and all phases of stores operations. Cable shall be supported with cable ties from the structure above or with approved T-bar wire clips two feet above ceiling tile and not lay on the ceiling grid system.

B. CONVENTIONAL CONDUIT: Must be used where cable is subject to damage, and/or required by the National Electrical Code or local governing authorities. When low voltage cable is routed from exposed into conduit, or pulled into wall or floor outlet, utilize connectors and fiber bushings to prevent cable jacket damage.

C. LOW VOLTAGE CLASS 2 WIRING IN RETURN AIR PLENUMS: Teflon or similarly insulated signal conductors may be utilized where low voltage, Class 2 signal cable is permitted by local codes as an alternate to conventional PVC insulated signal cable installed in conduit. Use must also comply with the following:

1. All low voltage signal wire shall meet or exceed applicable portions of specifications in regard to conductor characteristics. Only the Teflon insulation cable jacket material will be substituted for conventional PVC cable jacket material. The wire characteristics shall remain unchanged.

2. Power limited circuit signal cable as described here and in low voltage systems portions of this specification must by U.L. listed as having adequate fire resistance and low smoke producing characteristics and approved for the intended use (See National Electrical Code Section 725-2b and 760-4d). Low voltage, Class 2 signal cables (Teflon insulation) shall be manufactured by Hi-Temp Wires, Inc., Rockbesto Wires and Cable, Teledyne Thermatics, Belden Wire, Phalo or approved equal.

3. The low voltage, Class 2 signal cable installed without conduit shall not be visible in any area accessible to the public. Cables shall be routed in all areas so as to minimize the chance of accidental mechanical damage during any and all phases of the store's operations. Cable shall be supported with cable ties from the structure above and not from the ceiling T-bar grid system including ceiling suspension wires.

END OF SECTION

SECTION 16130 - BOXES

PART 1 - GENERAL

1.01 WORK DESCRIPTION: This section covers junction, pull and outlet boxes.

1.02 SUBMITTALS: Submit shop drawings on floor boxes and poke-thru devices for approval.

1.03 WORK SPECIFIED ELSEWHERE: "WIRING DEVICES 16140".

PART 2 - PRODUCTS

2.01 MATERIAL:

A. BOXES: Shall be manufactured from galvanized industry standard gauge steel, cast iron, cast aluminum or PVC as specified below.

1. Power distribution boxes shall be 8" X 8" X 4" (minimum) with blank cover. Each side and bottom (when installed) shall have a minimum of 2 each 3/4" knockouts. Manufacturers: Lea products of Everett, Ma; Unity Manufacturing of Garland, TX; or approved equal.

2. J-boxes shall be Steel City #6G-1/2 & 3/4 with blank cover 6-GCB or Raco #955 with blank cover #848.

B. FLOOR BOXES: Deep cast iron, rectangular or round type, fully adjustable before and after concrete pour. All floor boxes shall have covers, as specified in "Wiring Device - 16140". Boxes shall be Hubbell B-2436, B2503, B-4233, B-4333 or Steel City 641, 642, 643, 601 (Round) or Walker Parkerburg 889 (Round) or LEW 520 (round), 1101-DFB, 6262 - DFB/6304-S, 6263 - DFB/(2)6304 - S. See exception under "Floor Outlets" in Part 3 of this section.

1. For grade slab only and where approved by all governing authorities non-metallic floor boxes are permitted. CARLON catalog #E971FB with E97ABR adapters, Hubbell #PFB1 with PFBA1 adapter, Steel City #68-P with #600-4-FL brass ring, WALKER 883 and LEW L-56001. Covers and carpet flanges per "Wiring Devices 16140".

2. Floor boxes shall be furnished with all necessary accessories for a complete installation.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. BOXES:

1. All boxes shall be installed in accessible areas with removable covers.

2. All boxes shall be firmly supported from the building structure.

3. All outlet boxes shall be set flush with the surface of the wall, floor, or ceiling in concealed installation.

4. All boxes installed shall conform to the criteria governing the displacement and bending radius of wires and cables contained within them.

5. Provide segregated boxes or proper barriers where different services or systems are following the same routing.

6. Include all boxes required for a complete system regardless of indication on the contract drawings.

7. Provide pull or junction boxes to limit conduit runs to the equivalent of 270 degree bends and to facilitate wire pulling.

8. Close up all unused openings in boxes with approved fittings.

9. Provide an outlet box for each individual wiring device, lighting fixture, and communication component, unless otherwise noted.

10. Multiple devices indicated at a single location shall utilize gang mounted under common cover where possible.

11. Conceal outlet boxes in back of water cooler at locations recommended by the cooler manufacturer.

12. Junction boxes and circuit distribution boxes shall be permanently marked with the circuit identification numbers of the circuits contained therein.

13. Junction boxes (above ceilings and exposed) for emergency circuits shall be color coded with color(s) not used for other systems.

B. FLOOR OUTLETS:

1. In slabs not on grade furnish and install smoke and fire rated assemblies with fittings and firestop with suitable material to meet all legal requirements for floor penetrations. Exception: For all floor wiring devices designated as flush, Contractor shall furnish and install flush cast iron floor boxes. Provide fireproofing at all penetrations through slab for floor boxes. All wiring devices shall be fully circuited and wired by this Contractor.

2. For on grade slabs, install cast iron or PVC floor boxes as specified herein. Exception: The floor box installed as a part of the column raceway system, as depicted in the standard details shall be as noted in the details.

END OF SECTION

SECTION 16140 - WIRING DEVICES

PART 1 - GENERAL

1.01 WORK DESCRIPTION: This section covers line voltage wiring devices.

1.02 SUBMITTALS: Submit shop drawings and/or manufacturer's catalog sheets for approval.

PART 2 - PRODUCTS

2.01 SWITCHES AND RECEPTACLES:

A. GENERAL:

1. All devices shall be specification grade, heavy duty, standard configuration for the purpose of application. It shall be the contractor's responsibility to provide all necessary accessories to make complete and functioning devices or outlets.

2. Where pilot light only indicated, provide a correct voltage red jewel neon light mounted in standard switch box. For switches with pilot light provide neon light in toggle handle. See below.

B. SWITCHES FOR LOCAL CONTROL: Shall be flush tumbler, quiet type, with screw type terminals. Receptacles shall be Hubbell #1121-I or Leviton 1121.

1. Rated 120 volts, 20 AMPS, AC only, colored ivory.

2. Where indicated to have pilot light, each shall have a correct voltage red neon pilot light in Lexan handle. Toggle handle lights when load on.

3. Switches for direct control of single phase fractional HP motors, i.e. exhaust fans, shall be motor rated.

C. RECEPTACLES FOR CONVENIENCE OUTLETS: Shall be specification grade, heavy duty. Receptacles shall be Hubbell 5342 or Leviton 5342.

1. They shall be rated 125 VOLTS 20 AMPS unless otherwise noted.

2. They shall be colored ivory. Exceptions: Receptacles for emergency system outlets shall be colored red. Isolated ground receptacles shall be colored orange.

3. They shall be self-grounding type, 3 or more wires, single or duplex, as indicated with NEMA standard face slot configuration.

4. They shall have screw type terminals only.

5. Non-standard type outlets and special purpose power supply receptacles shall incorporate applicable requirements for the standard type and shall be as indicated.

6. For each non-standard receptacle, including all twist-lock devices and power supply outlets installed, furnish one matching attachment plug and connect same to the cord of the associated equipment.

D. PLATES FOR WALL MOUNTED DEVICES: Shall be selected as follows:

1. Plates for outlets shall be ivory.

2. They shall have the correct shape opening.

3. Material: Nylon for lighting switches and single and duplex standard receptacles.

E. MANUFACTURERS: Acceptable manufacturers for above specified devices are Arrow-Hart, General Electric, Hubbell, Pass and Seymour, Bryant, Eagle, or Leviton. Provide all devices by approved manufacturer.

2.02 DIMMING EQUIPMENT FOR INCANDESCENT SWITCHING:

A. GENERAL: Shall be provided as follows:

1. Select the dimmer to match the total load served.

2. Derate dimmers if they are ganged in common enclosure.

3. Use only solid state electronic type dimmers in 600W, 1000W, 1500W, or 2000W rating, as manufactured by General Electric, Lutron, or approved equal.

2.03 PUSHBUTTON, BELL AND TRANSFORMER:

A. Edwards catalog numbers 600, 55-6G5, and 88-50, or equal.

2.04 DEVICES FOR FLOOR BOX OUTLETS:

A. COVERPLATES: Shall be configured as follows:

1. For Rectangular Cast Iron Floor Box

Type Cover	Hubbell	Steel City	LEW
Flush Cap Combination	S-2625	P64-3/4-2	6203
Flush Duplex Flap	S-3825	P64-DS	6304DFB-1

a. Rectangular Carpet Flanges

Vendor	1-gang	2-gang	3-gang
Hubbell	S-3083	S-3084	S-3085
Steel City	P64-LCP	P64-2LCP	P64-3LCP
LEW	CF-6261	CF-1102-CP	CF-1103-CP

2. For Round, Metal or PVC Floor Box (Single Service Only)

Type Cover	Hubbell	Steel City	Walker	LEW
Flush Cap Combination	S-2525 CACP	P60-3/4-2	896CK-3/4	524
Flush Duplex Flap	S-3925	P60-CACP	895	DFB-1
Carpet Flange	S-3082	(N/A)	(N/A)	SCF-CP

3. For Hubbell round plastic floor box with low voltage divider use Hubbell no. SF39253 Brass 3 service cover with flange. Use PFBA1 adapter ring.

4. Above Floor Service Fittings

Telephone/

Vendor	1-Duplex Recept.	2-Duplex Recept.	Comm.
Hubbell	SC-3091	SC-3092	SC-3090
Steel City	SFH-50-RG	SFH-50-2RG	SPH-50-

Telecov

Vendor	1-Duplex Recept.	2-Duplex Recept.	Comm.
Walker	513AL	513D	501
LEW (FDN-300)	804	(2)804	805

B. OUTLET DEVICES:

1. Receptacles for power shall be as specified elsewhere in this section.

2. Coverplates for floor boxes with power receptacle shall be flush duplex flap as specified above.

3. Devices for communication outlets mounted in floor boxes are specified elsewhere in these specifications.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. GENERAL:

1. Install all devices indicated complete with cover plates.

2. Where necessary, set the long dimension of the plate horizontal, unless otherwise noted on contract drawings.

3. All 120V devices at a common location shall be "gang-mounted" under common cover. Do not "gang-mount" 277V devices.

4. All receptacles shall maintain a consistent orientation for neutral connection; use the silvered terminal if supplied with device.

5. Provide definite grounding method for all special outlets, including isolated ground devices and power supply receptacles.

END OF SECTION

SECTION 16160 - PANELBOARDS

PART 1 - GENERAL

1.01 WORK DESCRIPTION: This section covers distribution and lighting and power panels.

A. WORK SPECIFIED ELSEWHERE: Refer to Section 16180 for overcurrent protective devices and Section 16010 for labeling.

1.02 SUBMITTALS: Submit shop drawings for approval.

PART 2 - PRODUCTS

2.01 EQUIPMENT:

A. All equipment furnished under this section shall be in accordance with applicable NEMA standards.

B. PANELS:

1. Provide identification plate on face of each panelboard. Refer to Section 16010. Provide temporary identification as panels are installed.

2. Shall consist of completed dead-front assemblies including but not limited to the following:

a. Back Pan.

b. Bus Bars.

c. Sheet Metal Cabinet.

d. Switching and Over-Current Units.

e. Trim for Distribution Panels.

f. Trim and Door for Lighting and Miscellaneous Power Panels.

3. Sheet metal cabinets shall be minimum 20" wide fabricated from industry standard gauge galvanized sheet steel with corners lapped and fastened by approved methods. Provide minimum gutter space

in accordance with the National Electric Code. Where feeder cables supplying the mains of a panel are carried through a panel, the carrying panel shall be sized to include the additional wiring space.

4. Trims and doors shall be suitable for the required mounting. When installed, the whole assembly shall present a smooth flush appearance. Provide combination catch and lock with 2 sets of keys. All panels within same facility shall be keyed alike. Mount a clear plastic cover and sleeve with a typewritten directory--identifying each circuit--inside of panel door. Trims shall be fastened with adjustable screw clamps and self-supporting on cabinets if screws are removed. Overlap flush cabinets at least 1/2" all around. Paint the inside and outside of trims and doors with factory applied rust proofing and one finished coat to which field applied paint will adhere.

5. Switching and over-current units shall be bolt-on (connection to bus) circuit breakers or fusible switches as specified in the appropriate section of these specifications. All lighting and appliance power panelboards with main circuit breaker shall have main circuit breaker at the top.

6. Bus bars for panels shall have current capacities as indicated and sized for such capacities in accordance with Underwriters' Laboratories standards to limit temperature rise on any current carrying part to a maximum of 50°C above an ambient of 40° maximum. The bussing shall be braced throughout to conform to industry standard practice. Phase bussing shall be full height and tapped for sequence phasing of the branch circuit devices. Full size neutral bus bar shall be included. Bussing in distribution panelboards shall have uniform capacity throughout.

    a. Lighting and appliance power panels bussing shall be 98% copper.

    b. All bussing to be bolted.

    c. The voltage, number of phases and wires, size of main lug or main device (ampacity), number of branch circuit and their rating, and the number of spares and spaces are to be as noted on the contract drawings. Split bus panels where used are to be operated by 3-wire controlled contactor with capacity equal or greater than bus rating. A minimum of eight (8) common function branch circuits are required to justify the use of split bus panels for lighting control.

7. All 120/208V panels serving computer terminal receptacles to have isolated ground bus. Provide correct number, size and type of lugs or connectors for each phase bus, neutral bus, ground bus, main device and branch circuit. All panels shall be fully bussed.

C. LIGHTING PANELBOARDS:

1. Lighting and miscellaneous power panelboards shall be the types listed below manufactured:

   120/208 volt - Type "NLAB" as manufactured by General Electric Company

   120/208 volt - Type "NQOB" as manufactured by Square-D Company

   277/480 volt - Type "NHB" as manufactured by General Electric Company

   277/480 volt - Type "NEHB" or "I-Line" as manufactured by Square-D Company (as noted on drawings)

2. Branch circuit breaker locking devices (lock dogs) shall be installed as indicated on panelboard schedules.

3. Provide a Micarta laminated identification nameplate for each panelboard.

4. Other acceptable panelboard manufacturers are Square-D Company, Westinghouse and ITE.

5. Housing for all distribution, lighting and appliance panelboards shall be NEMA 1 rated, except for those panelboards in the mechanical equipment room which shall be NEMA 3R.

D. DISTRIBUTION PANELBOARDS:

1. Bussing shall be 98% copper or tin plated aluminum. Bus bars for distribution panels shall have current capacities as indicated on attached schedule and sized for such capacities in accordance with Underwriters' Laboratories standards. Bussing shall be braced throughout to conform to industry standard practice. Phase bussing shall be full height and arranged for sequence phasing (A-B-C top-to-bottom, Left-to-right and front-to-back) of branch switch devices. Provide correct number, size and type of lugs or connectors for each phase bus, neutral bar, ground bar, and branch circuit devices. The bus structure shall accommodate plug-on branch fusible switches or bolt-on branch circuit breakers if the distribution board is not fusible.

2. All fusible branch switches of fusible distribution boards shall be quick-make, quick-break type with visible blades and dual horsepower ratings. Switch handles shall physically indicate "ON" and "OFF" positions. Switches shall be lockable only in the "OFF" position and accept industrial type heavy duty padlock. Switch covers and handles shall be interlocked to prevent opening in the "ON" position. A means shall be provided to permit authorized personnel to release the interlock for inspection purposes.

3. All circuit breaker branches contained in circuit breaker distribution boards shall be molded case type as specified in Section 16180 of these Specifications.

4. Distribution panel shall be listed by Underwriters' Laboratories and shall bear the U.L. label.

5. Distribution Panels shall be Square-D Company "QMB" fusible type or Square-D Company "I-Line" circuit breaker type (when indicated). Westinghouse Type "FDP" and "CDP" Distribution Panels are acceptable.

6. Acceptable Distribution Panelboard manufacturers are General Electric, Square-D Company, Westinghouse and ITE.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. GENERAL:

1. Install panels with adequate support independent of the connecting raceways.

2. Mount all panels level and plumb. Flush panels not to extend beyond the face of the wall. All trim around panels shall be furnished and installed by Electrical Contractor.

3. Protect panels during construction with adequate covering.

4. Insulate flush mounted panels in exterior walls with 1/4" solid insulation board between back of cabinet and wall. Surface mounted panels installed directly on exterior masonry block wall shall have a 1/4" solid insulation board between back of cabinet and wall or panels shall be mounted in such a manner to provide a minimum of 1/2" air gap between back of panel and exterior wall.

5. Provide flush mounted panels with empty 1-1/4" conduit terminating in a junction box in the hung ceiling of the floor where it is mounted and also, in the hung ceiling in the floor below.

6. All overcurrent devices shall be labeled to accommodate 75^{o}C. insulated conductors. Labels shall appear on the overcurrent devices as well as on the enclosures.

END OF SECTION

SECTION 16170 - DISCONNECTS

PART 1 - GENERAL

1.01 WORK DESCRIPTION: This section covers individually mounted disconnect switch devices.

1.02 SUBMITTALS: Submit shop drawings for approval.

PART 2 - PRODUCTS

2.01 MATERIAL:

A. GENERAL:

1. Disconnect switches shall be general duty with quick-make, quick-break (QMQB) mechanism.

2. They shall have NEMA type enclosures as required and/or noted on the contract drawings with nameplates with a permanent record of type, size and horse-power ratings.

3. They shall have operating handles with definite "OFF" indications and defeatable door interlocks in the "ON" position.

4. Provide switch assembly, where the operating handle is an integral part of the enclosure base.

5. Fused disconnects shall have reinforced fuse clips for both standard and time delay fuses.

6. Provide multi-padlock capability for the operating handle.

7. Provide six pole disconnects where required for six lead motors.

B. MANUFACTURERS: Cutler-Hammer, General Electric, Siemens/ITE, Square D, and Westinghouse.

C. Overcurrent protective devices shall be in accordance with Section 16180 of these specifications.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. GENERAL: Refer to Section 16010 for labeling requirements.

1. All disconnects shall have nameplates identifying load being served.

2. Install fused or non-fused disconnect switches where indicated on the contract drawings or required by latest NEC or governing authorities.

3. They shall be installed with adequate hand access to and clearance for operation and fuse replacement.

END OF SECTION

SECTION 16180 - OVER-CURRENT PROTECTING DEVICES

PART 1 - GENERAL

1.01 WORK DESCRIPTION: This section covers circuit breakers, fuses and all over-current protecting devices.

1.02 SUBMITTALS: Submit shop drawings for approval.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. OVER-CURRENT DEVICES: Shall be labeled to accommodate 75°C insulated conductors. Labels shall appear on the overcurrent devices as well as on the enclosures. All items under this section shall conform to applicable NEMA and ANSI Standards.

B. CIRCUIT BREAKERS:

1. Circuit breakers shall be molded case, completely enclosed bolted connection devices.

2. They shall be quick-make, quick-break, trip free, trip indicating one-, 2- or 3-pole switching units.

3. All multi-pole breakers shall have common trip handles and all poles shall close, open or trip simultaneously.

4. They shall provide inverse time delay overload with instantaneous short circuit protection by means of a thermal-magnetic element.

5. AIC Rating: 120V and 208-240V breakers, minimum 10,000 AIC. 277V and 480V breakers, minimum 14,000 AIC. Series rating of breakers will not be allowed.

6. They shall be rated to withstand the available short circuit current at the line side of connection.

7. They shall be provided with non-welding contact surfaces and arc chutes.

8. Circuit breaker shall be Square D Type QOB or GE LAB.

C. FUSES:

1. Fuses 600V or less shall be cartridge type and shall be non-renewable.

2. Provide current limiting fuses, time delay or fast acting in accordance with drawings and diagrams. Main switchboard fuses: Bussman KRP-C for main interrupters and Bussman LPS-RK for distribution feeder switches.

3. Provide dual element, time delay fuses for motor feeders or branch circuits of motors larger than 1/2 HP. Use Buss LPS-RK, FRS-R (600V); LPN-RK, FRN-R (250V) for loads up to and including 600A and Buss KRP-C (600V) for loads above 600A. Refer to drawings for specific applications.

4. Provide proper type and size fuses for all fusible devices, including equipment furnished by owner. When selecting fuses, follow the recommendation of the protected equipment manufacturer.

5. Provide 10% spare fuses, with a minimum of 3 for each size and type, of each size and type fuse used on this facility. Deliver fuses to the owner's representative and provide a spare fuse cabinet on the HVAC Equipment Room Wall as shown.

6. Fuses above 600V shall be the type recommended for the equipment by the manufacturer and acceptable to the local utility company. Provide 3 spares of each such type and size of fuse installed.

7. Fuses shall be manufactured by Bussman, Shawmut or Littlefuse.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install circuit breaker in accordance with manufacturer recommendations.

END OF SECTION

16420 - ELECTRICAL SERVICE ENTRANCE

PART 1 - GENERAL

1.01 WORK DESCRIPTION: This section covers the electrical service to the building.

1.02 SUBMITTALS: Submit shop drawings for approval where noted.

1.03 QUALITY ASSURANCE:

1.04 WORK DESCRIBED ELSEWHERE: "Raceways" Section 16110, "Conductors" Section 16120.

A. GENERAL:

1. The permanent electrical supply for the project will be provided by Entergy. Electrical contractor shall provide secondary conduits and feeders and concrete pad for transformer.

2. File all applications necessary for the above - within adequate time - before permanent service is required.

3. Responsibility for the payment of any "non-recoverable" cost shall be included in the electric work.

4. It is intended that the existing overhead 120/240/3 overhead service be removed and a new 120/208/3 service installed.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. SERVICE ENTRANCE: Shall be conduit and cable. Conduit shall be concrete encased (Minimum 3" all around) where the length of the conduit from building exterior to the service transformer pad exceeds 15'-0". Concrete shall be colored with red dye.

1. Provide cable limiters where required.

2. Service entrance cable conductors shall be copper. Aluminum is acceptable only if required by the local utility company. Maximum

size of service entrance cable conductors is 750MCM. Full size neutrals shall be provided.

3. Ground conductors shall be sized per NEC 250-94.

B. CONDUIT: Shall be PVC Schedule 40 per Section 16110 of these specifications. Schedule 80 PVC is acceptable if required by the local utility company. Conduits entering the building (penetrating exterior wall or stub-up through slab) must be rigid steel. Provide appropriate flexible, waterproof couplings for penetrating exterior wall. Provide one empty service entrance conduit (for dual transformer configuration provide one empty service conduit from each transformer).

1. Provide proper floor and/or sleeves and glands for conduit.

2. Where metallic conduit is required or used, it shall be rigid steel and shall be painted with bituminous paint.

C. LIGHTNING SURGE ARRESTERS:

1. Lightning surge arrester must be included in the main switchboard when the isokeraunic level is 40 or higher.

2. When the isokeraunic level is less than 40 but more than 20, arrester are required in the main switchboard where the utility does not provide arrester on primary side of service transformer or at on site primary switchgear.

3. Arrester are to be factory installed in main switchboard.

<u>PART 3 - EXECUTION</u>

3.01 INSTALLATION:

A. GENERAL:

1. Install all equipment in accordance with the local utility company requirements.

2. Coordinate the service entrance installation with the power company's service department.

3. Provide appropriate sealing of all conduits and cables to prevent any water from entering the building and/or equipment. Where conduits enter the main switchboard room, install additional method to prevent moisture/water from entering the main switchboard through the conduits.

4. Provide all equipment necessary for the metering and insure the proper installation of the utility company's CT's.

5. When penetrating a foundation wall above the first floor slab, provide a gland type conduit sleeve.

6. Verify final location of metering equipment prior to completion of service entrance work.

7. Coordinate arrester location with utility representative.

END OF SECTION

SECTION 16450 - GROUNDING

PART 1 - GENERAL

1.01 WORK DESCRIPTION: All electrical systems shall be grounded in accordance with the National Electrical Code, Local Codes, these specifications and the contract drawings.

1.02 WORK DESCRIBED ELSEWHERE: "Conductors" section 16120.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. GENERAL:

1. Use green colored and coded insulated copper conductors.

2. Use approved ground clamp manufactured for such purpose.

3. Use approved grounding electrodes and rod.

4. Make all conductor to conductor, conductor to ground rod and conductor to steel grounds connections with approved exothermic welding method.

5. Ground rods: 5/8" diameter copper clad steel, minimum ten feet in length.

2.02 APPROVED MANUFACTURERS:

A. Approved manufacturers for exothermic welding process are as follows:

1. CADWELD

PART 3 - EXECUTION

3.01 INSTALLATION:

A. GENERAL:

1. Ground all systems and equipment with the best applicable industry practice.

2. Building steel shall be grounded in the area of main switchboard, and electric closets. A total of 15% of all steel columns shall be grounded through a driven ground rod system, #1/0 AWG cu. stranded conductor shall connect the rod to the steel columns.

3. Utilize the main water service pipe only if it is metallic type, minimum of 100' buried and the grounding effectiveness is established.

4. The point of connection to the service shall be as near to the water meter as possible.

5. Provide copper wire shunt at the street side of the water meter and/or main shut-off valve.

6. Where the domestic water service is non-metallic, installed with the use of insulated couplings, or installed in such a manner to negate the effectiveness of the ground, a supplemental ground shall be installed. The installation shall be as per contract drawings.

7. Install metallic raceways mechanically and electrically secure at all joints and at all boxes, cabinets, fittings and equipment. At the point of electrical service entrance, bond all metallic raceways together, with a ground conductor, and connect to the system ground bus. Bond all boxes as specified for equipment.

8. Provide separate green equipment ground conductor in all electrical raceways, to effectively ground all fixtures, panels, controls, motors, disconnect switches, exterior lighting standards, and non-current carrying metallic enclosure. Use bonding jumpers, grounding bushings, lugs, busses, etc., for this purpose.

9. Connect the equipment ground to the building system ground. Use the same size equipment ground conductors as phase conductors, up through No. 10 AWG. Use NEC Table 250-95 for conductor size with phase conductors No. 8 and larger, if not shown on the contract drawings.

10. Permanently connect the green ground conductor to each receptacle junction box (self-tapping screw).

11. Connect the ground conductor to the conduit with an approved grounding bushing, and to the metal frame with a bolted solderless lug. Bolts, screws and washers shall be bronze or cadmium-plated steel.

12. Provide a flexible ground strap, No. 6 AWG equivalent, at each flexible duct connection at each air handler, exhaust fan, and supply fan, and install to preclude vibration.

13. Provide one No. 6 TW copper wire in 1/2" conduit from the main telephone cabinet to the street side of the domestic water service (street side of water meter) or building ground connection.

14. Concrete encased rods or wires in foundations and footings with adequate electrical connections from each main reinforcing member to structural steel may be used, providing soil conditions are not restrictive and the net ground resistance is acceptable.

15. Provide separate grounding conductor in all feeders to 480V distribution panelboard feeders. Size of ground to be per NEC table 250-95.

16. Isolated ground is derived from the grounded Xo terminal of the secondary of a stepdown transformer. A separate insulated conductor(s) shall connect the Xo terminal to the isolated ground bar in panelboard(s) requiring isolated ground provisions. No portion of any isolated ground system shall be used to provide ground for any raceway and/or equipment.

B. SERVICE ENTRANCE:

1. Where the primary grounding electrode is not a metallic water service pipe utilize a made electrode system.

2. The service entrance shall be grounded at the transformer (outside the building) per Utility Co. requirements as well as at the switchboard ground bus.

END OF SECTION

SECTION 16500 - LIGHTING

PART 1 - GENERAL

1.01 WORK DESCRIPTION:

A. WORK INCLUDED: This section includes indoor and outdoor lighting fixtures and associated supports and lenses.

1.02 SUBMITTALS: Submit shop drawings for approval.

1.03 RESPONSIBILITY:

A. LIGHTING FIXTURES: All lighting fixtures and lamps shall be furnished and installed under the General Contract. Only lighting fixtures as indicated on the Lighting Fixture Schedule modified to satisfy local codes and ordinances, if required, and as manufactured by the "Approved Manufacturers" shall be accepted.

1. Even though a manufacturers catalog and/or drawing number is listed on the lighting fixture details, it shall be this Contractor's responsibility to furnish all required accessories or modifications to meet the specification requirements for lighting fixtures. This Contractor shall be responsible for verifying voltage requirements of fluorescent/HID lighting fixtures prior to ordering and, where required for plaster/gypboard ceiling, to order frames and/or modifications to fixtures.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. FIXTURES, GENERAL: Comply with the requirements specified below and lighting fixture schedule on the drawings.

1. Comply with Underwriters' Laboratories requirements. Lighting fixtures shall be listed and bear the U.L. label.

2. Comply with local building and electrical codes.

B. FIXTURE COMPONENTS, GENERAL: Furnish fixtures complete with all required accessories, components and hangers.

1. Metal parts shall be free from burrs and sharp corners and edges.

2. Sheet metal components shall be steel except as noted otherwise. Components shall be formed and supported to prevent warping and sagging. Pre-painted steel, before forming, shall not be used.

3. Doors, frames, and other internal access pieces shall be smooth operating and free from light leakage under operating conditions. Relamping shall not require use of tools. Doors, frames, lenses, diffusers, louvers, and other pieces shall be designed to prevent accidental falling during relamping and when secured in the operating position.

4. Suspended Fixture Support Components:

    a. Single stem hangers: 1/2 inch steel tubing with swivel ball fitting and ceiling canopy. Finish same as fixture.

    b. Rod hangers: 3/16 inch diameter steel rod, threaded and rust inhibited.

    c. Chain: 150 lb. rating. Use same gauge steel "s" hooks for attachment to fixture.

5. Sockets:

    a. All fluorescent sockets shall be held rigidly in place and shall contain spring brass contacts.

    b. Screw sockets shall be nickel-plated brass with a porcelain envelope.

    c. Mogul sockets shall have internal spring grips and a porcelain envelope.

6. Housings: Unless noted otherwise shall be of heavy gauge steel (CRS) and shall be formed so as to preclude sag, distortion, or "oil canning".

    a. Spun housings shall be brushed to remove tool marks.

b. Pre-painted steel, before forming, shall not be used.

C. FINISHES:

1. Fluorescent fixtures: All housing, door frames, ballast covers, and all other reflective surfaces shall be painted after fabrication with baked-on white enamel with a minimum reflectance of 89%.

2. All aluminum louver for fluorescent fixtures shall have iridescent inhibiting process treatment.

D. WIRING: All internal wiring shall be copper, 600 volt, temperature rated per U.L. standards.

1. Conform to local codes and ordinances.

2. Incandescent sockets shall be wired with high temperature wire per requirements of U.L. Internal wires (within fixture housing) shall be protected by braided sleeve. Auxiliary J-box shall be pre-wired and U.L. approved for 60°C supply wires.

3. Fluorescent fixtures shall have internal wiring sized not less than 18 gauge with thermoplastic insulation type required for U.L. listing and local codes and ordinances. Wiring connections within the wireway for stranded conductors shall be made using fully insulated, compression type, copper connectors. "Wirenuts" shall only be used with solid conductors.

E. GASKETS: Shall be of a closed cell material suitable for the applicable temperature and proposed environment. No gasket material shall be used which shall age, harden or permanently deform under pressure.

F. ACCESSORIES: All fixtures shall include plaster frames, trims, yokes, lenses in place, and all other appurtenances necessary to affect a complete installation. All fixtures shall be fabricated in a neat and workmanlike manner and shall conform to industry standards with regard to modularity, length and overall size.

G. LABELS: Label stating fixture type number and manufacturer name shall be placed in a conspicuous location on the exterior of the luminaire. Label stating voltage and maximum wattage shall be placed on the interior if incandescent fixtures.

H. OUTDOOR FIXTURES: Lighting and/or components of lighting fixtures which are exposed to the weather, shall be constructed of anodized aluminum or stainless steel.

1. Lighting fixtures and/or components not directly exposed to the weather, such as under extended canopies, may be constructed of steel with 2 coats of zinc chromate prime before application of the final finish.

O. EXIT SIGNS: Conform to UL924, "Emergency Lighting and Power Equipment. U.L. label shall be affixed.

1. Sign colors: Letters shall be red unless required otherwise by local code.

2. Minimum height of letters shall be 6" unless required otherwise by local code.

3. Stencil face shall consist of a brushed (Satin finish) aluminum faceplate with letters backed with break resistant translucent plastic. Include arrows as indicated from Plans.

4. Lamps for AC operation shall be two (2) each compact fluorescent with minimum 10,000 hrs. rated life. Lamps for DC operation shall have 50,000 hrs. rated life.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. GENERAL:

1. Where surface mounted fixtures are indicated for installation on low-density cellulose fiberboard, provide 1-1/2" ceiling spacers, unless U.L. approved for mounting directly to the ceiling material.

2. Provide plaster frames for all recessed lighting fixtures installed in gypboard/plaster ceilings unless otherwise approved by the Architect. Provide plaster frame designed and fabricated of such material to preclude the possibility of staining the plaster.

3. Properly support and align fixtures and provide all necessary steel shapes for support of the fixtures. Where local codes or ordinances require, provide independent support for each fixture. Coordinate complete fixture installation with the building construction.

4. Lighting fixture enclosures in fire rated ceilings shall conform to U.L. and lighting fixture manufacturers' requirements.

5. Square and rectangular fixtures shall be mounted with sides parallel to building lines, and parallel with ceiling lines.

6. Verify all ceiling systems and coordinate fixture type and accessories prior to ordering fixtures. Coordinate and cooperate with ceiling supplier in the preparation of ceiling shop drawings.

7. Install fluorescent fixtures as recommended by the manufacturer or as necessary to provide exact horizontal alignment, preventing horizontal or vertical deflection or angular jointing of fixtures suspended in continuous rows.

END OF SECTION

16910 – TELEPHONE WIRING/DATA WIRING

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Furnish and install all equipment, accessories and materials in accordance with these specifications and drawings to provide wiring and conduit system for the telephone system and data system.

PART 2 – PRODUCTS

2.01 WIRING

A. Provide ¾" conduit from 6" above the finished ceiling to junction box in the wall at each telephone/data device location.

B. Provide category 5 cables for each telephone outlet. Terminate at device location with RJ45 jack. Provide 10 ft. slack cable at telephone service board. Final termination by owner's telephone provider.

C. Provide pull string for each data terminal location. Wiring by owner.

PART 3 – EXECUTION

3.01 INSTALLATION

A. The installing contractor shall coordinate his work with all other trades so as not to interfere with the intended function of any system.

3.02 BUILDING SERVICE

A. The installing contractor shall provide conduits with pull string from the new building to Administration building telephone trunk line. Provide all necessary conduits, pull strings, backboards, punch down blocks and other necessary components.

B. Provide a 48" x 48" x ¾" plywood backboard mounted 6" above the floor at the telephone service entry point.

END OF SECTION

16920 - CONTROL WIRING

PART 1 - GENERAL

1.01 WORK DESCRIPTION:

1. All power and line voltage (120V or higher) control wiring and associated conduits to be furnished and installed by the Electrical Contractor.

2. All low voltage control/interlock wiring and associated conduits shall be furnished and installed by the HVAC Contractor.

3. All HVAC control devices (except manual motor start switches, hp rated control switches, and pilot light only units) for Electrical Contractor installed control systems shall be furnished and delivered by the HVAC Contractor to the Electrical Contractor for installation and connection. (Refer to Division 15 HVAC for equipment list.)

4. All installations shall be done in accordance with the approved drawings under the direct supervision of the HVAC Contractor.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. GENERAL:

1. Provide all conduit, wire and necessary appurtenances for a complete installation power system for the "furnished by others" equipment in accordance with these specifications and applicable code requirements.

2. Provide all disconnecting means called for on drawings and/or required by national electrical code or governing authorities.

3. Provide all fuses for equipment supplied by others.

4. Coordinate over-current protection types and sizes with the supplied equipment.

5. Manual motor start switch shall be equal to Square-D class 2510. Provide OL sized per HVAC Contractor instruction. Hp rated switches and pilot lights per section 16140 "Devices".

PART 3 - EXECUTION

3.01 INSTALLATION:

A. GENERAL: Install a complete system for the operation of the HVAC equipment requirements and these specifications.

END OF SECTION