

DIVISION 15 B - HEATING, VENTILATING AND AIR CONDITIONING

1.1 DESCRIPTION OF THE WORK

- A. Work under this section includes, but is not necessarily limited to, furnishing and installing the following:
1. Heating, ventilation, and air conditioning equipment.
2. Ductwork.
3. Register, grilles and diffusers.
4. Controls and control wiring.
5. Refrigerant work, piping and insulation.
B. All work under this contract shall be installed in compliance with the latest edition of the following codes and standards insofar as they apply:
1. ASHRAE Guide
2. National Electric Code.
3. NC State Building Code, Volume III, Heating and Air Conditioning.
4. The Electrical Specifications for this project.
5. SMACNA HVAC Duct Construction Standards.
6. All local codes and ordinances.
7. ARI rating.
8. Natural Gas Code.
C. These codes are minimum standards. If codes require a more stringent method of construction than the specifications require the codes shall govern.
D. The HVAC Contractor shall be licensed in North Carolina and have all local licenses required for the work.
E. Obtain all permits, licenses, inspections, etc., required for the work and pay for the same.

1.2 INTENT

- A. The intent of these specification and the accompanying drawing is to convey as reasonably as possible the requirements for a complete job ready for the building to operate. The HVAC Contractor shall take this into consideration and include in his bid allowance for contingencies as will allow him to provide minor pieces of equipment and labor not specifically indicated but required for the job to operate properly, at no additional cost to the Owner.

1.3 COORDINATION

- A. Coordinate work with other contractors. Notify Architect of apparent conflicts early to expedite construction. If structural damage appears imminent, stop work and notify Architect for a decision before resuming operations.
B. Locations shown are approximate. The HVAC Contractor shall refer to the architectural drawings for placement of equipment, fixtures, outlets, etc. Where locations are not clear, the HVAC Contractor shall obtain the exact locations from the Architect. The drawings do not give exact details as to elevations and locations of various pipes, fittings, ducts, conduit, etc., and do not show all offsets and other installation details which may be required.
C. Changes in duct or piping design caused by obstructions shall be submitted in sketch form for study and comment prior to execution. Additional cost will not be allowed for this type of work.

1.4 SHOP DRAWINGS

- A. Review and approval shall be by contractor.

PART 2 - PRODUCTS

2.1 EQUIPMENT

- A. All air handling devices/furnances must have the manufacturers recommended filter rack.

2.2 PIPING

- A. Refrigerant lines shall be sized strictly as recommended by manufacturer. Refrigerant piping shall be of Type K hard drawn copper. Thoroughly clean pipe prior to assembly. Provide charging and liquid line shut-off valve in each circuit. Refrigerant piping solder joints shall be made with nitrogen gas in the pipes to prevent oxidation.
B. Insulation on refrigerant suction line shall be 3/4 inch thick Armaflex. The insulation ends and joints shall be made tight with suitable adhesive and pressure sensitive tape to provide a vapor tight seal. Test system and remove insulation and properly replace if leaks develop. Use micron gauge and leak detector to insure against leaks.

- C. Condensate drain piping shall be 3/4 inch PVC pipe. Provide tee and plug at changes in direction. Route pipe to convenient drain on outside of building and spill on concrete splash block.

2.3 DUCTWORK

- A. Ductwork shall be built in accordance with SMACNA HVAC Duct construction standards. Furnish and install all supply, return, and ventilation ductwork shown, together with splitters, deflectors, dampers, etc. This work shall be constructed of new galvanized prime grade steel sheets. The gauges of metal to be used and the construction and bracing of joints shall be in accordance with the SMACNA recommendations.
B. Tape with pressure sensitive tape (duct tape) at all sheet metal joints.
C. Support from building structure on strap hangers not over 8 feet apart.

- D. Use manufactured turning vanes in each elbow where required or where indicated on drawings.
E. Flexible connectors shall be 3 inches wide, of fireproof material and used to isolate noise between equipment and ductwork on supply and return side of all units.
F. Round runouts, where used, shall be built in accordance with the above standards, and each runout shall also have manufactured side take off, adjustable quadrant damper at all accessible locations and shall be of Owens Corning INL-25 flexible duct with UL label. Flex duct lengths allowed up to the maximum allowable length by code. Duct must be supported with sufficient hangers in order to prevent sags. Serpentine routing will not be permitted. Where indicated on drawings, return air flexible duct shall be same. Quadrant damper to be 22 gauge easily adjustable manually with exterior handle (similar to H4C Walk-set) and is not to be mounted in side take-off.
G. Any duct dimensions shown on drawings are clear and free inside dimensions.
H. Gas units: Submit for approval. Provide all ventilation. Makeup air etc. as required by Code.

2.4 DUCT INSULATION

- A. Insulate all sheet metal supply and return ducts with one inch thick fiberglass 3.4 pound density, blanket insulation with foil facing and UL label, Owens Corning FRK25 or equal, spot glued six inch centers and tightly taped with three inch SMACNA approved glass fabric tape, with approved mastic.

2.5 THERMOSTATS

- A. Submit proposed thermostats for owner approval.

2.6 BASES FOR NEW EQUIPMENT IF REQUIRED

- A. Condensing Unit: Four inch thick concrete pad or precast pad.
B. Air Handlers/Furnances: As per manufacture's recommendations for crawl space installation.

PART 3 - EXECUTION

3.1 ROUTING OF PIPING

- A. The HVAC Contractor shall coordinate such routing with others, to line his work true to adjacent spaces and in a workmanlike manner and to use only short radius 90 degree elbows. Where required piping to be sturdily supported and separated in a manner satisfactory to the Architect.

3.2 ELECTRICAL WORK

- A. The electrical contractor shall supply complete power supply to HVAC disconnect, for the air conditioning, heating and ventilation equipment. Control wiring shall be by the heating and air conditioning contractor. See
B. From the load side of the first terminals inside the equipment, the HVAC Contractor shall be responsible for extending internal wiring as necessary for power and control of the equipment he furnishes, providing such additional safety switches, starters, junction boxes, etc., as may be required for full operation. HVAC Contractor is responsible for verifying that power terminals have been properly grounded prior to operating equipment.
C. All materials and workmanship shall be in accordance with the electrical specifications for the project. All wiring shall be color coded, and as-built wiring diagram prepared showing all connections and colors of wiring and delivered to the Owner.
D. Furnish certification for acceptance of control wiring from local electrical inspector prior to acceptance.

3.3 CLEAN UP

- A. During construction, keep the site clean of debris. Upon completion, and before final inspection, clean up the premises to remove all evidence of work. In addition upon completion of construction leave equipment clean.
B. Furnish one box of clean filters, for each size required, at the time of final inspection to the owner.

3.4 OPERATOR'S MANUAL AND DIAGRAM

- A. The HVAC Contractor shall prepare in one copy a manual describing the proper maintenance and operation of the systems. This manual shall not consist of standard factory instructions (although these may be included) but shall be prepared to describe this particular job.
B. The manual shall be bound, indexed, dated and signed by the HVAC Contractor.
C. Qualified representative of the HVAC contractor shall meet with the designated representatives of the Owner and the Owner's representative shall be instructed in the proper operation and maintenance of the control system and other systems.

3.5 GUARANTEE

- A. Guarantee all materials and labor included in the HVAC work for a period of one year from date of final acceptance by the owner. In addition, motor compressors shall be a nonprorated five year warranty. Any part or parts of the work or equipment which prove to be defective during the guarantee period shall be replaced at no additional cost to the owner.

DIVISION 16 - ELECTRICAL

PART 1 - GENERAL

1.1 DESCRIPTION OF THE WORK

- A. Work under this section includes, but is not necessarily limited to, furnishing and installing the following:

- 1. Electrical service and service equipment.
2. Lighting and power distribution system.
3. Lighting fixtures and lamps.
4. Wiring devices, plates, etc.
5. Source of power for all items of equipment.
6. Grounding.
7. Other requirements and/or systems where shown.
8. Requirements note within plans.

- B. All work shall be complete and items, equipment, etc., shall be electrically connected for proper and correct operation.

- C. All work under this contract shall be installed in accordance with the latest edition of the following codes and standards insofar as they apply:

- 1. The National Electrical Code.
2. The National Electrical Safety Code.
3. Underwriter's Laboratories, Inc., Standards and approved listings.
4. Electrical Testing Laboratories standards.
5. NC State Building Code, Latest Edition and Revisions.
6. All local codes and ordinances.

- D. The Electrical Contractor shall be licensed in the State of North Carolina and have all local licenses required for the work.

- E. Obtain all permits, licenses, inspections, etc., required for the work and pay for the same. Furnish final certificate of inspection and approval from the electrical inspector having jurisdiction prior to acceptance of the work.

- F. All work shall be done by skilled mechanics and shall present a neat, trim, workmanlike condition when complete.

1.2 INTENT

- A. The intent of these specifications and the accompanying drawings is to convey as reasonably as possible the requirements for a complete job ready for the building to operate. The Electrical Contractor shall take this into consideration and include in his base bid allowance for contingencies as will allow him to provide minor pieces of equipment and labor not specifically indicated but required for the job to operate properly, at no additional cost to the Owner.

1.3 COORDINATION

- A. Coordinate work with other contractors. Notify Architect of apparent conflicts early to expedite construction. If structural damage appears imminent, stop work and notify Architect for a decision before resuming operations.
B. Locations shown are approximate. The drawings do not give exact details as to elevations and locations of various pipes, fittings, ducts, conduit, etc., and do not show all offsets and other installation details which may be required.

1.4 SHOP DRAWINGS

- A. Review and approval by owner.

PART 2 - PRODUCTS AND MATERIALS

2.1 GENERAL

- A. All material shall be new and shall bear the manufacturer's name, trade name, and UL label where such standard has been established for the particular material. Materials shall be the standard products of manufacturer's regularly engaged in the manufacturer of the required type of equipment and the manufacturer's latest approved design.

- 1. Boxes installed in concealed locations shall be set flush with the finished surfaces and shall be provided with extension rings or plastic covers where required. Boxes shall be rigidly installed.

2.3 CONDUCTORS

- A. Conductors shall be color coded throughout, size #10 and #12 shall be factory coded, sizes #8 and larger may be color taped on the job. Color coding shall be: Standard Practice.
B. Conductors shall be manufactured by Dodge, Southwire or approved equal. Conductors shall meet the latest requirements of NEMA and IFCOA and shall be UL approved.

- C. Conductors shall be spliced and tapped as follows:

- 1. Size #10 and #12, use Ideal "Wing Nuts" or T4B "Riggy" connectors. Connectors shall be rated for 150 degrees C for use in recessed lighting fixtures.
2. Size #8 and larger shall be solderless screw and screw-clamping type, smoothly covered and shaped with rubber gum type with final cover vinyl plastic electrical type. In lieu of rubber gum and vinyl plastic type, factory fabricated approved performed insulating covers may be used. All connectors shall be UL approved.
3. No split-bolt type connectors may be used.

2.4 PANELBOARDS, SAFETY SWITCHES

- A. Panelboards shall comply with NEMA Standard PB 1 - Latest Edition and as manufactured by GE, Westinghouse or Square D. (Snap in or bolt in breakers are acceptable)
B. Safety switches shall be heavy duty type, size and rating as required for load service. Safety switches shall be fused or unfused as shown and/or as required. Safety switches serving motor loads shall be horsepower rated for load served.

2.5 LIGHTING FIXTURES AND LAMPS

- A. All light fixtures shall be approved by UL and NFPA6 and shall bear their label.
B. All fixtures shall be installed complete with lamps.
C. Fluorescent lighting fixture ballasts shall be high power factor type, with built-in automatic thermal resetting ballast protection. Ballasts shall have the lowest sound rating available for lamps specified.
D. Light fixtures shall be approved by the owner.
E. Downlights to be recessed unless otherwise noted.

2.6 WIRING DEVICES

- A. Wiring devices shall be specification grade by Bryant, Hubbell, or approved equal.

2.7 OTHER MATERIALS AND EQUIPMENT

- A. Other materials and equipment to be shown on the drawings, where no specific materials type is mentioned, a first class product of a reputable manufacturer may be used provided it conforms to the requirements of these specifications.

PART 3 - EXECUTION

3.1 CIRCUITS

- A. All circuits shall contain an insulated, green, copper grounding conductor, sized in accordance with Table 250-95 of the NEC. Ground conductors shall be connected to equipment grounded bus in panelboard and securely attached and grounded to the device or

3.2 GROUNDING TYPE CONVENIENCE OUTLETS AND SWITCHES

- A. Outlets and switches shall be solidly grounded to equipment grounding system with a green colored insulated conductor. Electrical connections shall be continuous from equipment ground bus in panelboard to the hex nut on the convenience outlet or switch. Romex wiring is acceptable where code approved.)

3.3 MOTORS

- A. All motors shall be connected to conduit system with short length (minimum length 12" and maximum length 24") of flexible liquidtight conduit.

3.5 IDENTIFICATION NAMEPLATES

- A. Provide permanent name plates for all panelboards, safety switches, wiring troughs, etc., for identification of equipment controlled, services, etc. Nameplates shall be securely and permanently attached to equipment.
B. All empty conduit runs shall be identified and indicated where they terminate.
C. Provide typewritten directory in each panelboard to clearly identify each circuit service, etc.

3.6 CONDUCTORS

- A. All conductors shall be continuous without splice between junction, outlet, device boxes, etc. No splicing will be permitted in panelboard cabinets, safety switches, etc.

3.7 CONDUCTORS IN PANELBOARDS, JUNCTION BOXES, ETC.

- A. Conductors shall be grouped together and laced with T4B "Ty-raps", or approved equal, in neat, substantial and approved manner. Each conductor in junction boxes, etc., shall be permanently marked showing panel board, room services, etc., with T4B or Brady wire markers.

3.8 JUNCTION AND/OR FULL BOXES

- A. Boxes shall be installed where necessary to avoid excessive runs and/or too many bends between outlets.

3.9 FULL WIRE

- A. Leave pull wire in each empty conduit run.

3.10 CONDUCTOR SIZES

- A. #8 and larger are considered feeders. Conductor sizes #10 and smaller are considered branch circuits.

3.11 GROUNDING

- A. All grounding shall be in accordance with Article 250 of the NEC. In addition, the following requirements shall be met:

- 1. Grounding conductors shall be installed as to permit the shortest and most direct path from equipment to ground. All ground connections to ground conductors shall be accessible.
2. Equipment ground continuity shall be maintained through flexible metal conduit.
3. All wiring devices equipped with grounding connection shall line solidly grounded to ground system with grounding conductors.
4. The frame of all lighting fixtures shall be securely grounded to the equipment ground system with grounding conductors.
5. An equipment enclosures, and non-current metallic parts of electrical equipment, raceway systems, etc., shall be effectively and adequately bonded to ground.
6. All equipment enclosures, and non-current metallic parts of electrical equipment, raceway systems, etc., shall be effectively and adequately bonded to ground.

3.12 ELECTRICAL WORK IN CONNECTION WITH OTHER WORK

- A. PLUMBING WORK: The Electrical Contractor shall furnish and install switches and devices as shown and electrically connect electric water heaters and water softener controls. All other electrical work required will be performed by Plumbing Contractor.
B. HEATING AND AIR CONDITIONING WORK: The Electrical Contractor shall install disconnect switches furnished by the HVAC Contractor, furnish and install wiring troughs, etc., as shown, and electrically connect all power wiring complete. Electrical power connections from disconnecting means to equipment will be accomplished by the HVAC Contractor. All control wiring will be accomplished by the HVAC Contractor. Coordinate all work associated with the HVAC Contractor.

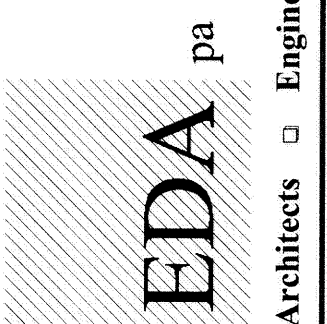
3.13 CLEAN UP

- A. During construction, keep the site clean of debris. Upon completion, and before final inspection, clean up the premises to remove all evidence of work. In addition upon completion of construction leave equipment clean.

3.14 GUARANTEE

- A. Guarantee all materials and labor included in the electrical work for a period of one year from date of final acceptance by the Owner. Any part or parts of the work or equipment which prove to be defective during the guarantee period shall be replaced at no additional cost to the Owner.

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