

Title and Summary

Invitation to Bid: No. FY10-0920
Invitation to Bid Title: (HVAC) Installation/Removal- Law Enforcement Complex
Invitation to Bid Publication: As follows:

- 08/09/2010 <http://www.orangeburgcounty.org/>
- 08/09/2010 bulletin board, 3rd Fl., Admin. Centre

Invitation Composition: Invitation to Bid No. FY10-0920 is composed of the following:

- Title and Summary pages
- Code Articles 1 through 7
- Scope of Work/Specifications
- American Recovery and Reinvestment Certification
- General Decision Wage Determination Information
- Buy American Certification
- Vendor Qualifications and Information
- Addendum Acknowledgement
- Certification of No Exceptions
- Certification of Preference(s)

Invitation Amendments: If any, will be published/posted on the following:

- <http://www.orangeburgcounty.org/>
- Bulletin boards located in/on
 - Management Area Public Works Division
 - 3rd Floor Administrative Centre, Procurement

Contracting Entity: Orangeburg County, South Carolina (“Owner”)
A political subdivision of the State of South Carolina

Procurement Coordinator: Procurement Director Jannella Shuler
Orangeburg County Procurement Office
1437 Amelia St. (“Administrative Center”)
Orangeburg SC 29115
(803) 533-6121 Office phone number
(803) 535-2307 Office fax number
jshuler@orangeburgcounty.org

Pre-Submission of Bids

- Requirements: Bidders must attend site visit and mandatory pre-bid conference
- Date/Time August 30, 2010 at 10:00 a.m.
- Location 1520 Ellis Avenue, Orangeburg, S. C. 29115
- Questions: If bidders have questions, same shall be
 - Directed to Procurement Director
 - Mode of Communication via e-mail only
 - No later than 12-Noon September 7, 2010

Bids:

- Submission Composition: Each submitted bid is required to be composed of the following, including fully completed and executed forms:
 - Code and Articles Acknowledgment
 - Addendum Acknowledgment
 - Vendor’s Certification of Qualifications and Information
 - Certification of No Exceptions
 - Certification of Preference(s)
 - American Recovery and Reinvestment Certification
 - Buy American Certification
- Submission Deadline: 2:00 p.m. on September 20, 2010
- Submission Location: Administrative Centre, 3rd Floor Procurement Office
- Opening Time: 2:05 p.m. on September 20, 2010
- Opening Location: Administrative Centre, 3rd Floor Training Room

Special Conditions

Intent/Award/Contract:

The intent to award, award, and the contract regarding FY10-0920 is subject to the following special conditions:

- Only as stated in the documents that compose the invitation to bid

Code and Articles Acknowledgement

Invitation to Bid No. FY10-0920

Incorporation by Reference.

Articles 1 through 7 of the Code are incorporated by reference as if set forth verbatim in this Request for Proposal. As stated in the Code, by submitting a bid, the vendor agrees that the Code governs this procurement from solicitation through completion of the resulting contract, including disputes, if any.

ACCESS TO CODE. On November 16, 2009, Orangeburg County Council, the governing body of Orangeburg County, repealed all aspects of its procurement policy and enacted the **Orangeburg County Procurement Code** (the "Code"). The Code may be accessed online without charge at <http://www.orangeburgcounty.org/Purchasing/code.html> In addition, a copy of the Code is available for review without charge at the Office of the Procurement Director. If neither of those options meets your needs, a hard-copy of the Code is also available for purchase at the Office of the Procurement Director.

<http://www.orangeburgcounty.org/>_____or

Method of Source Selection.

The source selection method applicable to this procurement is Request for Proposal Construction Services, Code §6-104.

The undersigned vendor understands and agrees to be bound to the Code regarding all matters arising from the Invitation to Bid identified above.

Printed Vendor Name

Signature of Vendor's Authorized Agent

Printed Name of Vendor's Authorized Agent

Title with Vendor of Vendor's Authorized Agent

Scope of Work and Specifications

Invitation to Bid No. FY10-0920 HVAC Installation and Removal Law Enforcement Complex

- Vendor shall complete the scope of work within sixty (60) days from date of signed contract. This scope of work together with the accompanying drawings and sketches shall define the minimum requirements for the removal of existing mechanical equipment and materials and the installation of new heating, air conditioning, and ventilating equipment and materials. The scope of this contract includes furnishing and installing all equipment, materials, labor and services necessary to provide complete and operating mechanical equipment and systems for the building.
- Existing 1974 and 1989 Mechanical Drawings are provided for “reference only” and are not to be considered as “as –built” drawings. The contractor must field verify all conditions related to the work of this contract.

In addition, as part of the scope of work:

A. The Mechanical Contractor shall serve as the “prime” contractor for this project. The Mechanical Contractor shall possess, as a minimum, a current AC 5 mechanical contractor’s license in order to perform the work for this project.

B. The Mechanical Contractor shall pay all fees, and shall secure all licenses and permits that are required and necessary in order to perform the work set forth on the drawings and in these specifications. He shall comply with the 2006 Editions of the International Building Code, International Existing Building Code, International Mechanical Code and Internal Plumbing Code as well as all state and local codes, requirements of ADA, EPA, NFPA, and all other authorities having jurisdiction over this work.

C. The Mechanical Contractor and his sub-contractors shall cooperate with the Owner to minimize conflicts, and to facilitate Owner operations. Use appropriate construction barriers such as saw horses, plastic barrier tape, wooden barriers, etc. as applicable to protect occupants during construction. Any damage to Owner’s property shall be repaired or replaced by Contractor at the discretion of the Owner.

D. Schedule all work to accommodate Owner’s requirements. All equipment installations must be scheduled with Owner.

E. Notify Owner a minimum of 48 hours prior to any necessary utility shut downs.

F. The work of the Contract includes coordination of the entire work of the project, including preparation of general coordination drawings, diagrams, schedules and control of site utilization in collaboration with Owner’s Representative from beginning of construction activity through project close-out and warranty period.

G. General Contractor working as a sub-contractor to the Mechanical Contractor will do all cutting and patching and general construction work which is necessary for the installation of the

work covered under this contract. Electrical Contractor working as a sub-contractor to the Mechanical Contractor shall provide all electrical power wiring, materials and labor as required for the removal of existing HVAC equipment and installation of the new HVAC equipment.

H. All roofing work shall be performed by a licenses roof contractor. There are no bonds on the existing roof. Any roof deficiencies shall be documented (photos) and brought to the Owner's attention prior to beginning any work. The roof shall be fully protected while installing HVAC equipment and engaging in any welding, soldering or brazing activities for the new equipment installations. Any new roof damage shall be repaired by the Contractor at no cost to the Owner.

I. All new rooftop HVAC equipment shall be installed on vibration isolators on existing equipment rails. The Contractor shall provide the isolators and all supplemental steel to properly support the new HVAC units on the existing rails. HVAC equipment shall be securely fastened (bolted or welded) to the vibration isolators and bolted or welded to the supplemental steel which in turn shall be bolted or welded to the existing equipment rails. Roofing Contractor shall repair any roof areas damaged as a result of the removal of the existing and installation of the new rooftop HVAC equipment.

J. Contractor shall remove and store ceiling tiles, ceiling grids and light fixtures in areas where new mechanical equipment and materials are to be removed and/or installed. Contractor shall reinstall ceiling grids, ceiling tiles and light fixtures after work has been performed. Damaged ceiling tiles shall be replaced with new tiles matching existing as closely as possible.

K. The contractor shall remove from the premises weekly all debris and trash for which he is responsible.

L. The Contractor shall ensure that the work area is secured before leaving each day. Contractor shall furnish and install all plywood, framing, hardware, etc. as required to temporarily separate the work area from owner occupied areas. The Contractor shall close and secure daily all roof and wall openings where equipment is being removed and/or replaced. All access to roofs (ladders, lifts, cranes, etc.) shall be secured and locked as applicable. Wall and roof openings shall be closed in such a manner as to make the building secure from exterior intrusion and weather tight.

M... All work included under this contract shall be performed by skilled and capable workmen under competent supervision employing the latest and best practices of the trades involved. All materials and equipment hereinafter specified shall be new and free from flaws and defects of any nature.

N... The Contractor and his appropriate sub-contractors are urged to visit the job site prior to submitting a bid for this work, in order to familiarize themselves with all existing conditions, and to verify all items that are related to this contract. Submission of a bid will be considered as evidence that this has been done, and no extra payments will be allowed this Contractor(s) on account of extra work made necessary by his failure to do so.

O. There are no asbestos containing materials believed to be installed on the existing mechanical systems. If suspicious materials encountered, they shall be brought to the Owner's attention before being disturbed. The Owner will have material tested and, if positive for asbestos or other hazardous material, will have the material removed under a separate contract.

P. The contractor is required to comply with all Davis-Bacon and Related Acts, in addition to the “Buy American” agreement for any work or equipment funded under the American Recovery and Reinvestment Act of 2009 which has been provided to Orangeburg County through the South Carolina Department of Energy. The contractor must comply with the minimum rates for wages for laborers and mechanics as determined by the Secretary of Labor in accordance with the provisions of the Davis-Bacon and Related Acts. The General Decision Wage Determination SC20100027 has been provided. The contractor will provide any necessary documentation demonstrating compliance with the “Buy American” agreement which certifies that all materials made or purchased under grant ELS-02 will be procured in the United States.

Q. Be bound by the requirements included in the Invitation to Bid, including the incorporated Code.

R. At the completion of the work, accompany a representative of Owner on a final inspection of work and based on that inspection, correct all defects in the work prior to submitting for or receiving final payment.

S. Maintain the following insurance coverage's:

1. Workers Compensation Insurance for all individuals who are on the work site at the request or direction of vendor.
2. General liability insurance for bodily injury and death commensurate with the risks associated with the scope of work and acceptable to County
3. Property casualty and premises liability insurance commensurate with the risks associated with the scope of work and acceptable to the County

Bear sole responsibility for the safety and health of all workers on the job, and comply with all applicable provisions of the Occupational Safety & Health Act.

Specifications

1.02 DEMOLITION OF EXISTING EQUIPMENT AND MATERIALS:

A. The Contractor shall remove a portion of the existing mechanical systems as indicated below.

B. Remove existing AH-A-1 VAV cooling air handler, Carrier Model 39ED21 located in Mechanical Room 172 and existing ACC-1, roof mounted air-cooled condensing unit, Carrier Model 38AD034. Existing roof equipment support rails for condensing unit shall remain in place. Existing equipment and materials that are removed by the Contractor shall be transported to a staging area on site for disposal by the Owner's personnel.

1. Remove a portion of the existing supply ductwork as required to remove the existing air handler. The remainder of the supply ductwork shall remain for re-connection to new air handler.
2. Existing pneumatic control devices, exposed pneumatic tubing and pneumatic control panel(s) shall be removed by the Controls Contractor under a separate contract.
3. Remove all associated refrigerant piping inside mechanical room, above ceiling and on roof.
4. Remove existing air handler condensate piping in mechanical room.
5. Disconnect existing electrical power wiring from air handler and condensing unit. Remove existing electrical disconnect switches (provide new disconnect switches for new equipment). Conduit and wiring shall remain in place for reconnection to new equipment.

C. Remove existing AH-A-2 constant volume cooling air handler, Carrier Model 39ED08 located in Mechanical Room 130 and existing ACC-2, roof mounted air-cooled condensing unit, Carrier Model 38AKS016. Existing roof equipment support rails for condensing unit shall remain in place. Condensing unit shall remain the property of the Owner and shall be delivered to a location determined by the Owner. All other existing equipment and materials that are removed by the Contractor shall be transported to a staging area on site for disposal by the Owner's personnel.

1. Remove a portion of the existing supply ductwork as required to remove the existing air handler. The remainder of the supply ductwork shall remain for re-connection to new air handler.
2. Existing pneumatic control devices exposed pneumatic tubing and pneumatic control panel(s) shall be removed by the Control Contractor under a separate contract.
3. Remove all associated refrigerant piping inside mechanical room, above ceiling and on roof.
4. Remove existing air handler condensate piping in mechanical room.
5. Disconnect existing electrical power wiring from air handler and condensing unit. Remove existing electrical disconnect switches (provide new disconnect switches for new equipment). Conduit and wiring shall remain in place for re-connection to new equipment.
6. Remove all (5) five existing electric duct heaters in supply duct system served by AH-A-2. Pneumatic controls, tubing and thermostats serving duct heaters shall be removed by the Control Contractor under a separate contract with the Owner. Remove existing electrical disconnect switches (provide new disconnect switches for new equipment). Existing power wiring and conduit shall remain in place for re-connection to new duct heaters. Disconnect supply ductwork as required to remove heaters.

D. Remove existing AH-A-3 constant volume cooling air handler, Carrier Model 39ED08 located in Mechanical Room 130 and existing ACC-3, roof mounted air-cooled condensing unit, Carrier Model 38AD016. Existing roof equipment support rails for condensing unit shall remain in place. Remove existing electric duct heater section mounted in the return air ductwork along with the remote heater electrical panel. Existing equipment and materials that are removed by the Contractor shall be transported to a staging area on site for disposal by the Owner's personnel.

1. Remove a portion of the existing supply, return and outside air ductwork as required to remove the existing air handler. The remainder of the supply, return and outside air ductwork shall remain for re-connection to new air handler.
2. Existing pneumatic control devices exposed pneumatic tubing and pneumatic control panel(s) shall be removed by the Control Contractor under a separate contract.
3. Remove all associated refrigerant piping inside mechanical room, above ceiling and on roof.
4. Remove existing air handler condensate piping in mechanical room.
5. Disconnect existing electrical power wiring from air handler, condensing unit and duct heater. Remove existing electrical disconnect switches (provide new disconnect switches for new equipment). Conduit and wiring shall remain in place for re-connection to new equipment.

E. Remove all (22) twenty two existing VAV boxes and electric heaters in the downstream supply ductwork served by AH-A-3.

1. Existing pneumatic controls serving VAV box heaters and wall thermostats shall be removed by the Control Contractor under a separate contract.
2. Disconnect existing power wiring and remove disconnects. Power wiring and conduit shall remain in place for re-connection to new VAV box heaters. Provide new electrical disconnects.
3. Disconnect supply ductwork as required to remove VAV boxes and heaters.

F. Contractor shall remove and store ceiling tiles, ceiling grids and light fixtures in areas where mechanical equipment and materials are to be removed and/or installed. Contractor shall reinstall ceiling grids, ceiling tiles and light fixtures after work has been performed. Damaged ceiling tiles shall be replaced with new tiles matching existing as closely as possible.

G. The Contractor shall verify the purpose and function of each mechanical item prior to removal to insure that no item which is required for the installation or operation of the new mechanical systems or existing systems remaining in place is accidentally removed. Before demolition begins have Owner identify any items of equipment or materials which the Owner may want to retain. Care shall be taken to not damage these items when removing. Deliver items to Owner in re-useable condition.

H. The Contractor shall provide new openings through the existing walls, floor and roofs as applicable for new piping, ductwork and conduit penetrations and the installation of new HVAC equipment.

I. Contractor shall seal all new ductwork, piping and conduit openings through all fire rated walls, floors and ceilings. Seal openings with 3M fire caulk as applicable.

J. Contractor shall document and call to the attention of the Owner any deficiencies, problems, damage or concerns about existing equipment or materials which are to be reused prior to beginning any demolition, along with any concerns about the existing conditions of building structures or finishes such as roof, walls or floors. Contractor shall inspect all existing mechanical roof rails and structural supports where new rooftop equipment is being installed to insure structural integrity of supports. Contractor shall also inspect existing ductwork in work areas to insure that duct work is properly sealed with no apparent air leakage.

1.03 DRAWINGS:

A. Existing 1974 and 1989 Mechanical Drawings are provided for "reference only" and are not to be considered as "as-built" drawings. The contractor shall field verify all conditions related to the work of this contract.

B. All new mechanical drawings and/or sketches are diagrammatic only and are intended to show general arrangement of component parts of the systems. Contractor shall coordinate his work with other trades and to suit actual jobsite conditions, and shall furnish and install all fittings, offsets, etc., necessary to avoid interference's without extra charge to the Owner.

C. In case of doubt as to drawings or specifications, Contractor shall consult Engineer and Owner, calling to his attention all discrepancies, errors, or omissions encountered. In no case shall Contractor proceed in uncertainty.

1.04 INSTALLATION OF NEW HVAC EQUIPMENT AND MATERIALS:

A. The Contractor shall install new mechanical systems and materials as indicated below.

B. Install a new modular central station type cooling only VAV air handler, AH-A-1, in Mechanical Room 172 and a new roof mounted air-cooled condensing unit, ACC-1, on existing roof equipment support rails. Equipment shall be Carrier Corp. models as specified hereinafter or equals by Trane Co.

1. Note: All air handler sections, including fan sled, shall be capable of being disassembled as required to pass through existing doorways with a clear inside open dimension of 35" wide x 79" high. Air handler shall be re-assembled in Mechanical Room and fan section aligned and balanced as recommended by the air handler manufacturer.
2. The air handler/condensing unit manufacturer shall provide factory equipment startup for this VAV system.
3. Install new air handler on 4" high concrete housekeeping pad or steel support frame.
4. Reconnect existing supply ductwork to new air handler. Provide transitions, offsets, turning vanes, etc. as applicable. Insulate new ductwork with duct wrap insulation to connection point with existing ductwork. See attached Mechanical Room 172 Plan.

5. Install all new interconnecting refrigerant piping between air handlers and condensing unit. Insulate refrigerant suction piping. Install new pipe portal on roof for pipe and conduit penetrations through roof. Remove and replace lay-in ceiling tiles and grids as required to install new refrigerant piping.
6. Install new full size condensate drain piping with P-trap and cleanout. Extend drain piping to nearest floor drain. Support piping on floor with pipe stanchions anchored to the concrete floor. Insulate condensate piping and trap with "Arm flex" type insulation.
7. Install new electrical disconnects for air handler and condensing unit and reconnect existing electrical power wiring from air handler and condensing unit as required.
8. Fabricate a new steel structural support frame for the new condensing unit. The frame shall be of sufficient height to allow 24" minimum from bottom of condensing unit to finished roof for service of unit and maintenance of roof. Frame shall be secured to the existing equipment rails. Condensing unit shall be secured to the structural frame through vibration isolators. Refer to attached Condensing Unit Installation Detail.
9. All new DDC controls, wiring, temperature sensors, conduits, etc. required for the operation of the AH-A-1/ACC-1 system along with the VAV boxes and heaters served by AH-A-1 shall be furnished and installed by the Control Contractor under a separate contract with the Owner. Coordinate mechanical equipment requirements with the Control Contractor.

C. Install a new commercial packaged type cooling only air handler, AH-A-2, in Mechanical Room 130 and a new roof mounted air-cooled condensing unit, ACC-2, on existing roof equipment support rails. Equipment shall be Carrier Corp. models as specified hereinafter or equals by Trane Co.

1. Note: All air handler sections shall be capable of being disassembled as required to pass through existing doorways with a clear inside open dimension of 35" wide x 79" high. Air handler shall be re-assembled in Mechanical Room as recommended by the air handler manufacturer.
2. Install new air handler on 4" high concrete housekeeping pad or steel support frame.
3. Reconnect existing supply ductwork to new air handler. Provide transitions, offsets, turning vanes, etc. as applicable. Insulate new ductwork with duct wrap insulation to connection point with existing ductwork. See attached Mechanical Room 130 Plan.
4. Install all new interconnecting refrigerant piping between air handlers and condensing unit. Insulate refrigerant suction piping. Install new pipe portal on roof for pipe and conduit penetrations through roof. Remove and replace lay-in ceiling tiles and grids as required to install new refrigerant piping.
5. Install new full size condensate drain piping with P-trap and cleanout. Extend drain piping to nearest floor drain. Support piping on floor with pipe stanchions anchored to the concrete floor. Insulate condensate piping and trap with "Arm flex" type insulation.
6. Install new electrical disconnects for air handler and condensing unit and reconnect existing electrical power wiring from air handler and condensing unit as required.
7. Install (5) new electric duct heaters in the supply duct system served by AH-A-2. Reconnect supply ductwork as required. Install new electrical disconnects and reconnect power wiring as required.
8. Fabricate a new steel structural support frame for the new condensing unit. The frame shall be of sufficient height to allow 24" minimum from bottom of condensing unit to finished roof for service of unit and maintenance of roof. Frame shall be secured to the

existing equipment rails. Condensing unit shall be secured to the structural frame through vibration isolators. Refer to attached Condensing Unit Installation Detail.

9. All new DDC controls, wiring, room temperature sensors, conduits, etc. required for the operation of the AH-A2/ACC-2 system along with the electric duct heaters shall be furnished and installed by the Control Contractor under a separate contract with the Owner. Coordinate mechanical equipment requirements with the Control Contractor.

D. Install a new commercial packaged type cooling only air handler, AH-A-3, in Mechanical Room 130 and a new roof mounted air-cooled condensing unit, ACC-3, on existing roof equipment support rails. Equipment shall be Carrier Corp. models as specified hereinafter or equals by Trane Co.

1. Note: All air handler sections shall be capable of being disassembled as required to pass through existing doorways with a clear inside open dimension of 35" wide x 79" high. Air handler shall be re-assembled in Mechanical Room as recommended by the air handler manufacturer.
2. Install new air handler on 4" high concrete housekeeping pad or steel support frame.
3. Reconnect existing supply ductwork to new air handler. Provide transitions, offsets, turning vanes, etc. as applicable. Insulate new supply ductwork with duct wrap insulation to connection point with existing ductwork. Refer to attached Mechanical Room 130 Plan.
4. Install new return air ductwork from sidewall return air grille to new air handler. Provide transitions, offsets, etc. as applicable. Insulate new return ductwork with duct liner insulation. Reconnect existing outside air duct to new return ductwork. Refer to attached Mechanical Room 130 Plan.
5. Install all new interconnecting refrigerant piping between air handlers and condensing unit. Insulate refrigerant suction piping. Install new pipe portal on roof for pipe and conduit penetrations through roof. Remove and replace lay-in ceiling tiles and grids as required to install new refrigerant piping.
6. Install new full size condensate drain piping with P-trap and cleanout. Extend drain piping to nearest floor drain. Support piping on floor with pipe stanchions anchored to the concrete floor. Insulate condensate piping and trap with "Arm flex" type insulation.
7. Install new electrical disconnects for air handler and condensing unit and reconnect existing electrical power wiring from air handler and condensing unit as required.
8. Install new electric heater section on discharge of AH-A-3. Reconnect supply ductwork as required. Install new electrical disconnects for air handler and heater and reconnect power wiring as required. Electrical Contractor shall replace existing breakers serving electric heater if required to match the heater manufacturer's MOCP, maximum over current protection requirements.
9. Fabricate a new steel structural support frame for the new condensing unit. The frame shall be of sufficient height to allow 24" minimum from bottom of condensing unit to finished roof for service of unit and maintenance of roof. Frame shall be secured to the existing equipment rails. Condensing unit shall be secured to the structural frame through vibration isolators. Refer to attached Condensing Unit Installation Detail.
10. All new DDC controls, wiring, room temperature and humidity sensors, conduits, etc. required for the operation of the AH-A3/ACC-3 system along with the electric heater section shall be furnished and installed by the Control Contractor under a separate contract with the Owner. Coordinate mechanical equipment requirements with the Control Contractor.

E. Install (22) twenty two new VAV boxes and electric heaters, VAV-1 through VAV-22, in the downstream supply ductwork served by AH-A-3 to replace the VAV boxes and heaters being removed. Install one new VAV box, VAV-23, with electric heater to serve Room 136 as indicated on attached sketch. Equipment shall be Carrier Corp. models as specified on schedule or equals by Trane Co.

1. Install new electrical disconnect switches for the 22 new VAV boxes with electric heat replacing units being removed. Reconnect existing power wiring as required.
2. Provide new power wiring, conduit, breaker and electrical disconnect for new VAV-23. Electrical Contractor shall run new wiring and conduit from electrical panels in the room designated as Electric. Radio & Telephone Room 155 on original drawings. Refer to attached Partial HVAC Renovation Floor Plan.
3. Reconnect supply ductwork to all VAV boxes/heaters as required.
4. All new DDC controls, wiring, VAV box actuators, room temperature sensors, conduits, etc. required for the operation of the VAV boxes and electric heaters shall be furnished and installed by the Control Contractor under a separate contract with the Owner. Coordinate mechanical equipment requirements with the Control Contractor.

F. Furnish and install a new mini-split ductless air conditioning system in Electrical Room as specified hereinafter as manufactured by Carrier Corp. or equal by Enviromaster Inc. and as indicated on attached sketches.

1. Suspend indoor air handler section from ceiling/roof construction. Install outdoor condensing unit on two (2) new equipment rails spanning at least two roof joists. Refer to attached Electrical Room 155 Plan and Ductless Outside Unit Installation Detail.
2. Install new interconnecting refrigerant piping for the indoor and outdoor units. Install a new pipe portal for piping and conduit penetrations through the roof deck. Refer to attached Pipe Portal Detail.
3. Roofing contractor shall flash equipment rails and pipe portals.
4. Electrical Contractor shall furnish and install all new power wiring, conduit, disconnect switches, etc. as required for the indoor and outdoor units. Electrical Contractor shall run new wiring and conduit from electrical panels in the room designated as Electric. Radio & Telephone Room 155 on original drawings. Refer to attached Electrical Room 155 Plan.
5. Install $\frac{3}{4}$ " PVC condensate drain piping from indoor air handler. Pipe condensate drain by gravity exposed in Electrical Room to exterior of building and spill on splash block on grade. Insulate drain piping with $\frac{1}{2}$ " minimum thick "Armaflex" type insulation. Properly support drains piping. Coordinate routing of refrigerant and drain piping in Electrical Room to avoid conflicts with existing conduits and wiring.
6. Remove and replace ceiling tiles and grid as required to install new ductless AC system.
7. Ductless system shall be operated 24/7 from a wired wall mounted thermostat furnished by the unit manufacturer. The Control Contractor shall furnish and install under a separate contract with the Owner, a DDC temperature sensor in the Electrical Room to monitor the space temperature.

G. Contractor shall remove and store ceiling tiles, ceiling grids and light fixtures in areas where mechanical equipment and materials are to be removed and/or installed. Contractor shall reinstall ceiling grids, ceiling tiles and light fixtures after work has been performed. Damaged ceiling tiles shall be replaced with new tiles matching existing as closely as possible.

H. The Contractor shall provide new openings through the existing walls, floor and roofs as applicable for new piping, ductwork and conduit penetrations and the installation of new HVAC equipment.

I. Contractor shall seal all new ductwork, piping and conduit openings through all fire rated walls, floors and ceilings. Seal openings with 3M fire caulk as applicable.

PART 2 - PRODUCTS

2.01 VAV CENTRAL STATION BUILT-UP AIR HANDLER (AH-A-1):

Note: All air handler sections, including fan sled, shall be capable of being disassembled as required to pass through existing doorways with a clear inside open dimension of 35" wide x 79" high. Air handler shall be re-assembled in the Mechanical Room as recommended by the air handler manufacturer.

A. Size Range: 11,340 CFM, Carrier Model Number: 39MN21 — Indoor Unit or equal by TRANE CO.

B. QUALITY ASSURANCE

1. Manufacturer Qualifications:

Company specializing in manufacturing the products specified in this section with minimum of five years documented experience.

2. Units shall be manufactured in a facility registered to ISO 9001:2000 manufacturing quality standard.

3. Air-handling unit assembly shall have UL 1995 certification for safety, including use with electric heat.

4. Products requiring electric connection shall be listed and classified by ETL and CSA as suitable for the purpose specified and indicated.

5. Coil performance shall be certified in accordance with AHRI Standard 410.

6. Air-handling unit shall be AHRI 430 listed and meet NFPA 90A requirements.

C. DELIVERY, STORAGE AND PROTECTION

1. All indoor units, painted or unpainted, shall be completely shrink-wrapped from the factory for protection during shipment. Tarping of bare units is unacceptable.
2. Inspect for transportation damage and store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

D. START-UP REQUIREMENTS

1. Do not operate units until ductwork is clean, filters are in place, bearings lubricated, condensate properly trapped, piping connections verified and leak tested, belts aligned and tensioned, all shipping braces have been removed, and fan has been test run under observation.
2. Unit manufacturer shall provide factory start-up of air handler and VFD drive.

E. GENERAL DESCRIPTION

1. Unit shall ship in the number of sections necessary to meet project requirements and shall ship in as many splits as specified in selection software. Split options as follows:
 - a. Shipped in sections — shipping split.
 - b. Shipped assembled.
2. Unit shall be factory-supplied, central station air handler. The air-handling unit may consist of a fan with the following factory-installed components as indicated on the equipment schedule.
 - a. 2-in. flat filter section with 2 sets of 30% efficient filters.
 - b. Direct expansion cooling coil section.
 - c. Horizontal draw-thru fan section.

F. CASING

1. Construction:
 - a. Unit shall be constructed of a complete frame with easily removable panels. Removal of any panel shall not affect the structural integrity of the unit.
 - b. All units shall be supplied with 14-gage or heavier, G-90 galvanized steel base rails. Bolton legs are NOT acceptable. Perimeter lifting lugs for overhead lifting shall be provided on each section. Slings units in place of lifting lugs shall not be acceptable.

- c. Unit shall be thermally broken to minimize the conduction path from the inside of the casing to the outside.
- d. Casing panels (top, sides, and bottom) shall be constructed of galvanized steel, and shall have one of the following exterior finishes as specified:
 - 1. Pre-painted with a baked enamel finish passing 500-hour salt spray test (ASTM B-117) for pre-painted steel and 125-hour marine level 1 cohesion test (ASTM G-85.A5) for pre-painted steel.
- e. Casing panels (top, sides, and bottom) shall be constructed of galvanized steel, and shall have one of the following interior finishes as specified:
 - 1. Pre-coated with a silver zeolite antimicrobial material registered by the US EPA for use in HVAC applications.
- f. Casing panels (top, sides, and bottom) shall be one piece, double-wall construction with insulation sealed between the inner and outer panels. Panel assemblies shall not carry an R-value of less than 13.
- g. Casing deflection shall not exceed a 1:200 ratio when subject to an internal pressure of \pm 6-in. wg. Casing leakage rate shall be less than 1% at 6 in. wg of nominal unit airflow or 50 cfm, whichever is greater. Leakage rate shall be tested and documented on a routine basis on random production units. Optionally, factory witness leak testing and/or test reports shall be available.
- h. Side panels shall be easily removable for access to unit and shall seal against a full perimeter automotive style gasket to ensure a tight seal.
- i. The panel retention system shall comply with UL 1995 which states all moving parts (for example, fan blades, blower wheels, pulleys, and belts) that, if accidentally contacted, could cause bodily injury, shall be guarded against accidental contact by an enclosure requiring tools for removal.
- j. Accessibility options shall be as follows:
 - 1. Hinged double-wall access door on either side with removable access panel(s) on the other side.
- k. Fan supports, structural members, panels, or flooring shall not be welded, unless aluminum, stainless steel, or other corrosion-resistant material is used. Painted welds on unit exterior steel or galvanized steel are not acceptable.
- l. All coil sections shall be double wall construction with insulation sealed between the inner and outer panels. Panel assemblies shall not carry an R-value of less than 13. Single height coil sections shall have removable frame sections to facilitate vertical coil extraction.

2. Access Doors:

Access doors shall be one piece, double-wall construction with insulation sealed between the inner and outer panels. Panel assemblies shall not carry an R-value of less than 13.

3. Drain Pans:

Drain pans shall be insulated double wall stainless steel construction. The pan shall be sloped toward the drain connection. Drain pan shall have 1 1/2-in. MPT connection exiting through the hand side or opposite side of the casing as specified. One drain outlet shall be supplied for each cooling coil section. Drain pan shall allow no standing water and comply with ASHRAE Standard 62. Where 2 or more coils are stacked in a coil bank, intermediate drain pans shall be provided and the condensate shall be piped to the bottom drain pan. The bottom coil shall not serve as a drain path for the upper coil.

G. FANS

1. General:

- a. Forward-curved fans shall have one double-width double-inlet (DWDI) fan wheel and scroll. They shall be constructed of galvanized steel with baked enamel. They shall be designed for continuous operation at the maximum rated fan speed and motor horsepower. Fans shall have an AMCA class rating corresponding to the static pressure at which the fan is designed to operate (Class I or II). Completed fan assembly shall be dynamically balanced in accordance with 1989 ARI Guideline G and ANSI S2.19-1986 at design operating speed using contract drive and motor if ordered.
- b. Fan wheels shall be keyed to the shaft and shall be designed for continuous operation at maximum rated fan speed and motor horsepower. Fan wheels and shafts shall be selected with a maximum operating speed 25% below the first critical.
- c. Fan motor shall be mounted within the fan section casing on slide rails equipped with adjusting screws. Motor shall be high efficiency, open drip proof or totally enclosed fan cooled NEMA Design B with size and electrical characteristics as shown on the equipment schedule. Premium efficiency motors shall be available. Motor shall be mounted on a horizontal flat surface and shall not be supported by the fan or its structural members. All three-phase motors shall have a $\pm 10\%$ voltage utilization range and a 1.15 minimum service factor. Motor shall be compliant with EPACT where applicable. Single-phase motors shall be available up to and including 5 hp.

2. Performance Ratings:

Fan performance shall be rated and certified in accordance with AHRI Standard 430.

3. Sound Ratings:

Manufacturer shall submit first through eighth octave sound power for fan discharge and casing radiated sound.

4. Mounting:

Fan scroll, wheel, shaft, bearings, drives, and motor shall be mounted on a common base assembly. The base assembly is isolated from the outer casing with factory-installed isolators and rubber vibration absorbent fan discharge seal. A canvas style duct connection between fan discharge and cabinet is not acceptable. Units shall use 2-in. deflection spring isolators.

5. Fan Accessories:

a. Forward-curved fans:

1. Variable frequency drives with or without bypass.

6. Flexible Connection:

The base assembly is isolated from the outer casing with factory-installed isolators and rubber vibration absorbent fan discharge seal. A canvas style duct connection between fan discharge and cabinet is not acceptable.

H. BEARINGS AND DRIVES

1. Bearings:

Self-aligning, grease lubricated, anti-friction with lubrication fittings extended to drive side of fan section. Optional grease fittings extended to the exterior of the casing are available.

- a. Size 03 to 110 forward-curved fans: Cartridge type bearings for Class I fans. Heavy-duty pillow block type, self-aligning, regreasable ball or roller type bearings selected for a minimum average life (L50) of 200,000 hours or optionally for an (L50) of 500,000 hours.

2. Shafts:

Fan shafts shall be solid steel, turned, ground, polished and coated with a rust inhibitor.

3. V-Belt Drive:

Drive shall be designed for a minimum 1.2 service factor as standard with a 1.5 service factor option and/or a factory-supplied extra set of belts. Drives shall be fixed pitch with optional variable pitch for motors 15 hp and less. All drives shall be factory mounted, with sheaves aligned and belts properly tensioned.

I. COILS

1. All direct expansion (DX) refrigerant coils shall be provided to meet the scheduled performance. All coil performance shall be certified in accordance with AHRI Standard 410. All direct expansion coils shall be tested at 450 psig air pressure. Direct expansion coils shall be designed and tested in accordance with ASHRAE/ANSI 15 Safety Code for Mechanical Refrigeration (latest edition).
2. General Fabrication:
 - a. All refrigerant coils shall have minimum 1/2-in. OD copper tubes mechanically expanded into fins to ensure high thermal performance with lower total flow and pumping requirements. Minimum tube wall thickness shall be 0.016 inches.
 - b. Aluminum plate fin type with belled collars.
 - c. Aluminum-finned coils shall be supplied with die-formed casing and tube sheets of mill galvanized steel or stainless steel as specified.
3. Refrigerant Coils:
 - a. Headers shall be constructed of copper with brazed joints.
 - b. Standard circuiting selections include:
 1. Row split intertwined, multiple distributor arrangement for sizes 03-110.
 - c. Replaceable nozzle, brass refrigerant distributors and seamless copper distribution tubes are supplied to ensure uniform flow.

J. FILTER SECTIONS

1. Flat filter sections shall accept 2-in. filters. Sections shall include side access slide rails.

K. ELECTRICAL ACCESSORIES:

1. Bypass for Variable Frequency Drives:
 - a. 200-230 v/3 Ph/60 Hz (1 to 7.5 Hp), 460-575 v/3 Ph/60 Hz (1 to 20 Hp), 380 v/3 Ph/50 Hz (1 to 15 Hp):
 1. 4-position panel-mounted disconnect style switch with lockable handle (locks not provided), meets OSHA 1910.
 2. Switch position indication (LINE/OFF/ DRIVE/TEST).
 3. Adjustable motor overload with trip indication (LINE position).
 4. Manual overload reset button.
 5. Horsepower rated for motor applications.
 6. Direct control (no contactors, relays, or holding coils).

7. Complete isolation of inverter in LINE position.
8. NEMA 12 type metal enclosures.
9. Terminal strip provided for field power supply wiring.
10. Lug connection for field ground wire.
11. Gold flashed, auxiliary switch contact set (for switch position monitoring).
12. Factory mounted, wired to VFD and motor, and run tested (motor and VFD must be factory supplied and installed).
13. UL; UL, Canada; CE listed.

2. Variable Frequency Drives:

- a. Factory-mounted variable frequency drives (VFDs) shall be wired to factory-supplied motors.
 - b. Factory-supplied VFDs are programmed and started up from the factory and qualify the VFD, through ABB, for a 24-month warranty from date of commissioning or 30 months from date of sale, whichever occurs first.
 - c. The VFD parameters are programmed into the controller and removable keypad. In the event that the VFD fails and needs replacement, the program can then be uploaded to the replacement VFD via the original keypad.
 - d. The VFD package as specified herein shall be enclosed in a UL Listed Type 1 enclosure, completely assembled and tested by the manufacturer in a facility registered to ISO 9001:2000. The VFD tolerated voltage window shall allow the VFD to operate from a line of +30% nominal, and -35% nominal voltage as a minimum.
 1. Environmental operating conditions: 0° to 40C continuous. Variable frequency drives that can operate at 40C intermittently (during a 24-hour period) are not acceptable and must be oversized. Altitude 0 to 3300 feet above sea level, less than 95% humidity, non-condensing.
 2. Enclosure shall be rated UL type 1 and shall be UL listed as a plenum rated VFD. Variable frequency drives without these ratings are not acceptable.
 - e. All VFDs shall have the following standard features:
 1. All VFDs shall have the same customer interface, including digital display, and keypad, regardless of horsepower rating. The keypad shall be removable, capable of remote mounting and allow for uploading and downloading of parameter settings as an aid for start-up of multiple VFDs.
 2. The keypad shall include Hand-Off-Auto selections and manual speed control. The drive shall incorporate "bumpless transfer" of speed reference when switching between "Hand" and "Auto" modes. There shall be fault reset and
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“Help” buttons on the keypad. The Help button shall include “on-line” assistance for programming and troubleshooting.

3. There shall be a built-in timeclock in the VFD keypad. The clock shall have a battery back up with 10 years minimum life span. The clock shall be used to date and time stamp faults and record operating parameters at the time of fault. If the battery fails, the VFD shall automatically revert to hours of operation since initial power up. The clock shall also be programmable to control start/stop functions, constant speeds, PID parameter sets and output relays. The VFD shall have a digital input that allows an override to the time clock (when in the off mode) for a programmable time frame. There shall be four (4) separate, independent timer functions that have both weekday and weekend settings.
4. The VFDs shall utilize pre-programmed application macros specifically designed to facilitate start-up. The application macros shall provide one command to reprogram all parameters and customer interfaces for a particular application to reduce programming time. The VFD shall have two user macros to allow the end-user to create and save custom settings.
5. The VFD shall have cooling fans that are designed for easy replacement. The fans shall be designed for replacement without requiring removing the VFD from the wall or removal of circuit boards. The VFD cooling fans shall operate only when required. To extend the fan and bearing operating life, operating temperature will be monitored and used to cycle the fans on and off as required.
6. The VFD shall be capable of starting into a coasting load (forward or reverse) up to full speed and accelerate or decelerate to set point without safety tripping or component damage (flying start).
7. The VFD shall have the ability to automatically restart after an overcurrent, over-voltage, under-voltage, or loss of input signal protective trip. The number of restart attempts, trial time, and time between attempts shall be programmable.
8. The overload rating of the drive shall be 110% of its normal duty current rating for 1 minute every 10 minutes, 130% overload for 2 seconds. The minimum FLA rating shall meet or exceed the values in the NEC/ UL table 430-150 for 4-pole motors.
9. The VFD shall have integral 5% impedance line reactors to reduce the harmonics to the power line and to add protection from AC line transients. The 5% impedance may be from dual (positive and negative DC bus) reactors, or 5% AC line reactors. Variable frequency drives with only one DC reactor shall add AC line reactors.
10. The VFD shall include a coordinated AC transient protection system consisting of four 120-joule rated MOVs (phase to phase and phase to ground), a capacitor clamp, and 5% impedance reactors.
11. The VFD shall be capable of sensing a loss of load (broken belt or broken coupling) and signal the loss of load condition. The drive shall be programmable to signal this condition via a keypad warning, relay output and/ or over the serial

communications bus. Relay outputs shall include programmable time delays that will allow for drive acceleration from zero speed without signaling a false underload condition.

12. If the input reference (4 to 20 mA or 2 to 10 v) is lost, the VFD shall give the user the option of either (1) stopping and displaying a fault, (2) running at a programmable preset speed, (3) holding the VFD speed based on the last good reference received, or (4) causing a warning to be issued, as selected by the user. The drive shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communication bus.
 13. The VFD shall have programmable "Sleep" and "Wake up" functions to allow the drive to be started and stopped from the level of a process feedback signal.
- f. All VFDs to have the following adjustments:
1. Three (3) programmable critical frequency lockout ranges to prevent the VFD from operating the load continuously at an unstable speed.
 2. Two (2) PID set point controllers shall be standard in the drive, allowing pressure or flow signals to be connected to the VFD, using the microprocessor in the VFD for the closed loop control. The VFD shall have 250 mA of 24 vdc auxiliary power and be capable of loop powering a transmitter supplied by others. The PID set point shall be adjustable from the VFD keypad, analog inputs, or over the communications bus. There shall be two parameter sets for the first PID that allow the sets to be switched via a digital input, serial communications or from the keypad for night setback, summer/winter set points, etc. There shall be an independent, second PID loop that can utilize the second analog input and modulate one of the analog outputs to maintain set point of an independent process (i.e., valves, dampers, etc.). All set points, process variables, etc. shall be accessible from the serial communication network. The set points shall be set in Engineering units and not require a percentage of the transducer input.
 3. Two (2) programmable analog inputs shall accept current or voltage signals.
 4. Two (2) programmable analog outputs (0 to 20 mA or 4 to 20 mA). The outputs may be programmed to output proportional to Frequency, Motor Speed, Output Voltage, Output Current, Motor Torque, Motor Power (kW), DC Bus voltage, Active Reference, and other data.
 5. Six (6) programmable digital inputs for maximum flexibility in interfacing with external devices typically programmed as follows: There shall be a run permissive circuit for damper or valve control. Regardless of the source of a run command (keypad, input contact closure, time clock control, or serial communications) the VFD shall provide a dry contact closure that will signal the damper to open (VFD motor does not operate). When the damper is fully open, a normally open dry contact (end-switch) shall close. The closed end-switch is wired to a VFD digital input and allows VFD motor operation. Two separate safety interlock inputs shall be provided. When either safety is opened, the motor

shall be commanded to coast to stop, and the damper shall be commanded to close. The keypad shall display “start enable 1 (or 2) missing.” The safety status shall also be transmitted over the serial communications bus. All digital inputs shall be programmable to initiate upon an application or removal of 24 vdc.

6. Three (3) programmable digital Form-C relay outputs. The relays shall include programmable on and off delay times and adjustable hysteresis. Default settings shall be for run, not faulted (fail safe), and run permissive. The relays shall be rated for maximum switching current 8 amps at 24 vdc and 0.4 A at 250 vac; Maximum voltage 300 vdc and 250 vac; continuous current rating 2 amps RMS. Outputs shall be true Form C type contacts; open collector outputs are not acceptable.
 7. Seven (7) programmable preset speeds.
 8. Two independently adjustable accelerate and decelerate ramps with 1 to 1800 seconds adjustable time ramps.
 9. The VFD shall include a motor flux optimization circuit that will automatically reduce applied motor voltage to the motor to optimize energy consumption and audible motor noise.
 10. The VFD shall include a carrier frequency control circuit that reduces the carrier frequency based on actual VFD temperature that allows the highest carrier frequency without derating the VFD or operating at high carrier frequency only at low speeds.
 11. The VFD shall include password protection against parameter changes.
- g. The keypad shall include a backlit LCD display. The display shall be in complete English words for programming and fault diagnostics (alphanumeric codes are not acceptable). The keypad shall utilize the following assistants:
1. Start-up assistants.
 2. Parameter assistants.
 3. Maintenance assistant.
 4. Troubleshooting assistant.
- h. All applicable operating values shall be capable of being displayed in engineering (user) units. A minimum of three operating values from the list below shall be capable of being displayed at all times. The display shall be in complete English words (alphanumeric codes are not acceptable):
1. Output Frequency
 2. Motor Speed (rpm, percentage, or Engineering units)
 3. Motor Current

4. Calculated Motor Torque
 5. Calculated Motor Power (kW)
 6. DC Bus Voltage
 7. Output Voltage
- i. The VFD shall include a fireman's override input. Upon receipt of a contact closure from the fireman's control station, the VFD shall operate at an adjustable preset speed. The mode shall override all other inputs (analog/ digital, serial communication, and all keypad commands) and force the motor to run at the adjustable, preset speed. "Override Mode" shall be displayed on the keypad. Upon removal of the override signal, the VFD shall resume normal operation.
- j. Serial Communications:
1. The VFD shall have an RS-485 port as standard. The standard protocols shall be Modbus, Johnson Controls N2 bus, and Siemens Building Technologies FLN. Optional protocols for LonWorks, BACnet, Profibus, Ethernet, and DeviceNet shall be available. Each individual drive shall have the protocol in the base VFD. The use of third party gateways and multiplexers is not acceptable. All protocols shall be "certified" by the governing authority. Use of noncertified protocols is not allowed.
 2. Serial communication capabilities shall include, but not be limited to: run-stop control, speed set adjustment, proportional/integral/derivative (PID) control adjustments, current limit, accelerate/decelerate time adjustments, and lock and unlock the keypad. The drive shall have the capability of allowing the DDC to monitor feedback such as process variable feedback, output speed/ frequency, current (in amps), percent torque, operating hours (resettable), and drive temperature. The DDC shall also be capable of monitoring the VFD relay output status, digital input status, and all analog input and analog output values. All diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote VFD fault reset shall be possible. The following additional status indications and settings shall be transmitted over the serial communications bus — keypad "Hand" or "Auto" selected, bypass selected, the ability to change the PID set point, and the ability to force the unit to bypass (if bypass is specified). The DDC system shall also be able to monitor if the motor is running in the VFD mode or bypass mode (if bypass is specified) over serial communications. A minimum of 15 field parameters shall be capable of being monitored.
 3. The VFD shall allow the DDC to control the drive's digital and analog outputs via the serial interface. This control shall be independent of any VFD function. For example, the analog outputs may be used for modulating chilled water valves or cooling tower bypass valves. The drive's digital (relay) outputs may be used to actuate a damper, open a valve or control any other device that requires a

maintained contact for operation. In addition, all of the drive's digital and analog inputs shall be capable of being monitored by the DDC system.

4. The VFD shall include an independent PID loop for customer use. The independent PID loop may be used for cooling tower bypass value control, chilled water value control, etc. Both the VFD control PID loop and the independent PID loop shall continue functioning even if the serial communications connection is lost. The VFD shall keep the last good set point command and last good digital output (DO) and analog output (AO) commands in memory in the event the serial communications connection is lost.
- k. EMI/RFI Filters:
- All VFDs shall include EMI/RFI filters. The onboard filters shall allow the VFD assembly to be CE Marked and the VFD shall meet product standard EN 61800-3 for the First Environment restricted level.
- l. All VFDs through 50 hp shall be protected from input and output power miswiring. The VFD shall sense this condition and display an alarm on the keypad.
- m. Operational Functions:
1. The drive shall contain two separate acceleration/ deceleration times with auto tuning for optimum setting (0.1 to 6000 seconds) with choice of linear, S, or C curves that shall be factory programmed to match the fan load and prevent nuisance over current fault trips.
 2. The drive shall be equipped with both local/ remote and manual/auto keys on touchpad.
 3. The drive shall be equipped with a quick setup key.
 4. The drive shall contain 15 preset speeds, which can be activated from the keypad, terminal inputs, and host computer.
 5. The drive shall have the capability of storable special custom user setting.
 6. The drive shall restart into a rotating motor operating in either the forward or reverse direction and match that frequency.
 7. The drive shall have adjustable soft stall (10% to 150%) which reduces frequency and voltage of the inverter to sustain a run in an overload situation factory programmed for each motor's characteristics.
 8. The drive shall be capable of performing a time base pattern run using 4 groups of 8 patterns each using the 15 preset speed values for a maximum of 32 different patterns.
 9. The drive shall have adjustable UL listed electronic overload protection (10% to 100%) factory programmed to match each motor's FLA/RLA ratings.
 10. The drive shall have a custom programmable volt/hertz pattern.

n. Protective Features:

1. The drive shall be rated for 200,000 AIC (ampere interrupting capacity). The use of input fuses to achieve this rating shall not be acceptable.
2. The drive shall have external fault input.
3. The drive shall be capable of resetting faults remotely and locally.
4. The drive shall be programmable to alert the following alarms:
 - a) Over torque alarm.
 - b) Inverter overload pre-alarm.
 - c) Motor overload pre-alarm.
 - d) Braking resistor overload pre-alarm.
 - e) Inverter overheat pre-alarm.
 - f) Undercurrent alarm.
 - g) Over current pre-alarm.
 - h) Communication error alarm.
 - i) Cumulative timer alarm.
 - j) Executing retry.
5. The drive shall identify and display the following faults:
 - a) Over current during acceleration trip.
 - b) Over current during deceleration trip.
 - c) Over current during normal run trip.
 - d) Over current on the DC Bus during acceleration trip.
 - e) Over current on the DC Bus during deceleration trip.
 - f) Over current on the DC Bus during normal run trip.
 - g) Load end over current trip detected at start-up (output terminals, motor wiring, etc.).
 - h) U-phase short circuit trip detected at start-up.
 - i) V-phase short circuit trip detected at start-up.
 - j) W-phase short circuit trip detected at start-up.

- k) Overvoltage during acceleration trip.
- l) Overvoltage during deceleration trip.
- m) Overvoltage during normal (constant speed) run trip.
- n) Inverter overloaded trip.
- o) Motor overloaded trip.
- p) Inverter overheat trip.
- q) Emergency off trip message.
- r) EEPROM failure during write cycle.
- s) EEPROM abnormality during initial reading.
- t) RAM error.
- u) ROM error.
- v) CPU error.
- w) Communication interruption error.
- x) Gate array error.
- y) Output current detection circuit error.
- z) Option PCB error trip.
- aa) Low operating current trip.
- bb) Main circuit under voltage trip.
- cc) Over torque trip.
- dd) Software detected earth fault trip.
- ee) Hardware detected earth fault trip.
- ff) Inverter type form mismatch error.
- gg) EEPROM type form mismatch error.

6. Monitor Functions:

- a. The drive digital display shall be capable of displaying the following: Frequency, percent current, current amps, percent voltage I/O, voltage in volts I/O, RPM, GPM, I/O watts, torque, and input reference signal, kWh.
- b. The drive shall have 320 programmable parameters which can be changed while the drive is operating.

- c. The drive's 353 parameters shall be adjustable from the 8-key touchpad or computer link.
- d. The drive's 8-key touchpad shall be NEMA 12 rated.
- e. The drive's keypad shall be capable of being extended 15 ft from the drive.
- f. The drive shall contain a reset of all parameters to factory default settings or user defaults (whichever one is chosen).
- g. The drive shall have 2 programmable analog outputs programmable to 17 choices.
- h. The drive shall have one programmable relay output programmable to 67 choices.
- i. The drive shall have 8 programmable digital inputs programmable to 54 choices.
- j. The drive shall have a pulse train output proportional to frequency (48, 96, 360 times frequency).
- k. The drive shall have an elapsed time meter.

2.02 COMMERCIAL PACKAGED CONSTANT VOLUME AIR HANDLERS (AH-A-2 & A-3):

Note: All air handler sections shall be capable of being disassembled as required to pass through existing doorways with a clear inside open dimension of 35" wide x 79" high. Air handler shall be re-assembled in Mechanical Room as recommended by the air handler manufacturer.

A. Size Range: 2,400 to 6,000 Cfm Nominal Airflow, 15 Tons Nominal Cooling Capacity, Carrier Model Numbers:40RUA16 (Direct-Expansion Coil) or equal by TRANE CO.

B. 1.01SYSTEM DESCRIPTION

1. Indoor, packaged air-handling unit for use in commercial split systems. Unit shall have a multi-position design and shall be capable of horizontal or vertical installation on a floor or in a ceiling, with or without ductwork. (Only vertical units are to be applied without ductwork.)
2. Unit with direct-expansion coil shall be used in a refrigerant circuit with a matching air-cooled condensing unit. Unit with chilled water coil shall be used in a chilled water circuit.

C. QUALITY ASSURANCE

1. Coils shall be designed and tested in accordance with ASHRAE 15 Safety Code for Mechanical Refrigeration (U.S.A.), latest edition.
2. Unit shall be constructed in accordance with ETL (U.S.A.) and ETL, Canada, standards and shall carry the ETL and ETL, Canada, labels.

3. Unit insulation and adhesive shall comply with NFPA-90A (U.S.A.) requirements for flame spread and smoke generation. Insulation shall contain an EPA-registered immobilized antimicrobial agent to effectively resist the growth of bacteria and fungi as proven by tests in accordance with ASTM standards G21 and 22 (U.S.A.).
4. Unit shall be manufactured in a facility registered to the ISO 9001:2000 manufacturing quality standard.
5. Direct-expansion and chilled water coils shall be burst and leak tested at 435 psi (2999 kPa).

D. DELIVERY AND STORAGE

Units shall be stored and handled per manufacturer's recommendations.

E. EQUIPMENT

1. Indoor mounted, draw-thru, packaged air-handling unit that can be used in a suspended horizontal configuration or a vertical configuration. Unit shall consist of forward-curved belt-driven centrifugal fan(s), motor and drive assembly, pre-wired fan motor contactor, factory-installed refrigerant metering devices (direct-expansion coil units), cooling coil, 2-in. (51-mm) disposable air filters, and condensate drain pans for vertical or horizontal configurations.
 - a. Base Unit:
 1. Cabinet shall be constructed of mill-galvanized steel.
 2. Cabinet panels shall be fully insulated with 1/2-in. (12.7-mm) fire-retardant material. Insulation shall contain an EPA-registered immobilized antimicrobial agent to effectively resist the growth of bacteria and fungi as proven by tests in accordance with ASTM standards G21 and 22 (U.S.A.).
 3. Unit shall contain non-corroding condensate drain pans for both vertical and horizontal applications. Drain pans shall have connections on right and left sides of unit to facilitate field connection. Drain pans shall have the ability to be sloped toward the right or left side of the unit to prevent standing water from accumulating in pans.
 4. Unit shall have factory-supplied 2-in. (51 mm) throwaway-type filters installed upstream from the cooling coil. Filter access shall be from either the right or left side of the unit.
 - b. DX coil is 4-row and consists of copper tubes with sine-wave aluminum fins bonded to the tubes by mechanical expansion. Suction and liquid line connections or supply and discharge connections shall be made on the same side of the coil.

1. Direct-expansion coils shall feature factory installed thermostatic expansion valves (TXVs) for refrigerant control. The TXVs shall be Puron® R-410A compatible and capable of external adjustment. Direct-expansion heat pump coils shall have a factory-installed bypass line and check valve assembly around the TXVs to allow liquid flow from the coil to the outdoor unit during the heating mode. Coil tubing shall be internally rifled to maximize heat transfer.

c. Motor:

1. Fan motor of the size and electrical characteristics specified on the equipment schedule shall be factory supplied and installed.
2. Motors rated at 1.3 through 3.7 hp (0.97 through 2.76 kW) shall have internal thermal overload protection. Motors rated at 5 hp (3.73 kW) shall be protected by a circuit breaker.
3. Evaporator-fan motor shall have permanently lubricated, sealed bearings and inherent automatic-reset thermal overload protection or manual reset calibrated circuit breakers. Evaporator motors are designed specifically for Carrier and do not have conventional horsepower (hp) ratings listed on the motor nameplate. Motors are designed and qualified in the “air-over” location downstream of the cooling coil and carry a maximum continuous bhp rating that is the maximum application bhp rating for the motor; no “safety factors” above that rating may be applied.
4. All evaporator-fan motors 5 hp and larger shall meet the minimum efficiency requirements as established by the Energy Policy Act of 1992 (EPACT), effective October 24, 1997.

d. Special Features:

1. An alternate motor and/or medium-static or high-static drive shall be available to meet the airflow and external static pressure requirements specified on the equipment schedule.
2. Units shall be painted with an American Sterling Gray finish.
3. AH-A-3 shall be furnished with an accessory electric heater section:
 - a) Heaters for nominal 240, 480, or 575-volt, 3-phase, 60 Hz shall be factory-supplied for field installation as shown on the equipment drawings. Electric heat assembly shall be ETL (U.S.A.) and ETL, Canada, agency approved, and shall have single-point power wiring. Heater assembly shall include contactors with 24-v coils, power wiring, 24-v control wiring terminal blocks, and a hinged access panel. Electric heater section shall be mounted on air handler discharge.

2.03 COMMERCIAL GRADE AIR-COOLED CONDENSING UNIT (ACC-1):

A. Size Range: 30 Nominal Tons at 460 volts - 60 Hz, Carrier Model Number: 38APD030 or equal by TRANE CO.

B. SYSTEM DESCRIPTION

Outdoor-mounted, air-cooled condensing unit with Puron® refrigerant (R-410A) suitable for on-the-ground or rooftop installation. The 38APD unit shall have two independent refrigeration circuits and shall consist of two, four, five or six rotary scroll compressors. Unit shall have air-cooled coils, propeller- type condenser fans, a control box, and shall discharge condenser air vertically upward as shown on certified drawings. Unit shall be used in refrigeration circuit with a central station air-handling unit or direct-expansion coils.

Unit manufacturer shall provide factory startup for condensing unit with the VAV air handler specified above.

C. QUALITY ASSURANCE

1. Unit performance shall be rated in accordance with ARI Standard 365, latest edition (U.S.A).
2. Unit construction shall comply with latest edition of ASHRAE 15 Safety Code, UL 1995, and ASME applicable codes (U.S.A. codes).
3. Unit shall be manufactured in a facility registered to ISO 9001:2000 Manufacturing Quality Standard.
4. Base unit shall be constructed in accordance with UL standards and CSA.
5. Unit cabinet shall be capable of withstanding 500-hour salt-spray exposure per ASTM B117 (scribed specimen).
6. Design pressure shall be 650 psig (4482 kPa).
7. Unit shall be functional checked at the factory.

D. DELIVERY, STORAGE, AND HANDLING

Unit shall be shipped as single package and shall be stored and handled per unit manufacturer's recommendations.

E. WARRANTY

Entire unit shall be warranted for one year – parts and labor. Compressors shall be warranted for an additional 4 years, 5 years total compressor warranty.

F. EQUIPMENT

1. General: Factory assembled, single-piece, air-cooled condensing unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, compressors, nitrogen holding charge, and special features required prior to field start-up.
2. Unit Cabinet:
 - a. Cabinet shall be galvanized steel casing with a baked enamel powder or pre-painted finish.

- b. Cabinet shall be capable of withstanding 500-hr salt spray test in accordance with ASTM (U.S.A.) B-117 standard.
- c. Control box access panels shall be hinged for service access.
- d. Lifting holes shall be provided to facilitate rigging.

3. Fans:

- a. Condenser fans shall be direct-drive propeller type, discharging air vertically upward.
- b. All condenser fan motors shall be totally enclosed 3-phase type with permanently lubricated ball bearings, class F insulation and internal, automatic-reset thermal overload protection or manual reset calibrated circuit breakers.
- c. Shafts shall have inherent corrosion resistance.
- d. Fan blades shall be statically and dynamically balanced.
- e. Condenser-fan openings shall be equipped with PVC-coated steel wire safety guards.

4. Compressors:

- a. Compressors shall be rotary scroll.
- b. Operating oil charge and a crankcase heater control oil dilution.
- c. Compressors shall be mounted on two rails having rubber in shear vibration isolators.
- d. Staging of compressors shall provide unloading capability. Digital compressor unloading control shall be provided on the lead circuit to allow 22 total stages of capacity control for optimal VAV operation.
- e. Compressor motors shall be cooled by refrigerant gas passing through motor windings and shall have either internal line break thermal and current overload protection or external current overload modules with compressor temperature sensors.

5. Condenser Coils:

- a. Coil shall be air-cooled microchannel heat exchanger (MCHX) and shall have a series of flat tubes containing a series of multiple, parallel flow microchannels layered between the refrigerant manifolds. Microchannel coils shall consist of a two-pass arrangement. Coil construction shall consist of aluminum alloys for the fins, tubes and manifolds in combination with a corrosion-resistant coating on the tubes.
- b. Tubes shall be cleaned, dehydrated, and sealed.

c. Assembled condenser coils shall be leak tested and pressure tested at 650 psig (4482 kPa).

6. Refrigeration Components:

a. Refrigeration circuit components shall include liquid line temperature relief device, pressure transducers, liquid line shutoff valve, suction shutoff valve, suction line accumulators, nitrogen holding charge, and compressor oil.

b. Long line length check valves are required for liquid line installation on all linear line length applications of more than 100 ft (30.5 m) to prevent liquid migration during unit shutdown. For any 025-030 size dual circuit unit application where evaporator is located higher than the condensing unit, check valves are required for linear line length above 55 ft (16.8 m).

c. Units shall include one factory-installed suction line accumulator for each refrigerant circuit.

7. Controls and Safeties:

a. Unit ComfortLink™ controls shall include:

1. Optional scrolling marquee display.
2. Carrier Comfort Network® (CCN) system capability.
3. Unit control with standard pressure transducer, discharge pressure transducer and suction temperature thermistors.
4. Current alarm list and alarm history list on display.
5. Automatic compressor lead/lag control.
6. Service run test capability.
7. Compressor minimum run time (3 minutes) and minimum off time (3 minutes).
8. Service diagnostic mode.
9. Self-contained low voltage control circuit.
10. Cycle condenser fans to maintain proper head pressure control.
11. Capacity control with staging compressors.
12. Optional digital scrolls to stage compressors and cycle digital compressor for maintaining desired leaving air temperature set point.
13. Alarm relay output to indicate when unit is in alarm condition.

b. Minimum unit safety devices shall include:

1. Solid-state compressor lockout to provide optional reset capability at the space thermostat if any of the following safety devices trip and shut off compressor.

- a) Compressor lockout protection for internal or external overload.
- b) Low pressure protection.
- c) High pressure protection (high pressure switch or internal).
- d) Compressor reverse rotation protection.
- e) Loss of charge protection.
- f) Low suction superheat protection.
- g) Short cycle protection.
- h) Suction and discharge pressure transducers.
- i) Circuit breakers or fuses for short circuit protection of compressors.

8. Electrical Requirements:

All unit power wiring shall enter unit cabinet at a single location.

9. Special Features:

a. Low Ambient Control:

1. Control shall regulate fan motor speed in response to the saturated condensing temperature of the unit. The control shall be capable of operating with outdoor temperatures at 20 F (28.9 C).

2. Motormaster® low ambient control shall be available as a factory-installed option or field-installed accessory for all units.

b. Digital Compressor Option:

Modification shall include digital compressor to provide incremental steps for tighter temperature control. The digital compressor shall be factory-installed.

c. Non-Fused Disconnect:

A non-fused disconnect shall be factory-installed.

d. Long Line Length Check Valves:

Long line length check valves are available as factory-installed options or field-installed accessories on all units and shall be furnished by the manufacturer if deemed necessary given the actual length of refrigerant piping.

e. BACnet Translator Control:

BACnet control shall be provided as a field-installed accessory for all units to provide interface between unit and a BACnet Local Area Network (LAN, i.e., MS/TP EIA-485).

f. Security Grilles/Hail Guards:

Units shall be supplied with factory-installed or field-installed louvered, sheet metal panels which securely fasten to the unit to provide condenser coil protection against hail and physical damage.

g. Vibration Isolators:

Unit manufacturer shall provide vibration isolators for the condensing unit.

2.04 LIGHT COMMERCIAL GRADE AIR COOLED CONDENSING UNITS: (ACC-2 & ACC-3):

A. Size Range: 15 Tons at 460 volts – 60 Hz, Carrier Model Numbers:38AUD16, Dual Circuit or equal by TRANE CO.

B. SYSTEM DESCRIPTION

Outdoor-mounted, air-cooled condensing unit suitable for on-the-ground or rooftop installation. Unit shall consist of multiple hermetic scroll air-conditioning compressor assemblies, an air-cooled coil, propeller-type condenser fans, and a control box. Unit shall discharge supply air upward as shown on contract drawings. Unit shall be used in a refrigeration circuit matched with a packaged air-handling unit.

C. QUALITY ASSURANCE

1. Unit shall be rated in accordance with AHRI Standard 360.
2. Unit construction shall comply with ANSI/ASHRAE 15 safety code latest revision and comply with NEC.
3. Unit shall be constructed in accordance with UL 1995 standard and shall carry the UL and UL, Canada label.
4. Unit cabinet shall be capable of withstanding 500-hour salt spray exposure per ASTM B117 (scribed specimen).
5. Air-cooled condenser coils for hermetic scroll compressor units (38AUZ) and 38AUD shall be leak tested at 150 psig, and pressure tested at 650 psig.

6. Unit shall be manufactured in a facility registered to ISO 9001:2000 manufacturing quality standard.

D. DELIVERY, STORAGE, AND HANDLING

Unit shall be shipped as single package only, and shall be stored and handled according to unit manufacturer's recommendations.

E. WARRANTY

Entire unit shall be warranted for one year – parts and labor. Compressors shall be warranted for an additional 4 years, 5 years total compressor warranty.

F. EQUIPMENT

1. General:

a. Factory-assembled, single piece, air-cooled condensing unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, compressor, holding charge, and special features required prior to field start-up.

2. Unit Cabinet:

a. Unit cabinet shall be constructed of galvanized steel, bonderized and coated with a prepainted baked enamel finish.

b. A heavy-gauge roll-formed perimeter base rail with forklift slots and lifting holes shall be provided to facilitate rigging.

3. Condenser Fans:

a. Condenser fans shall be direct driven, propeller type, discharging air vertically upward.

b. Fan blades shall be balanced.

c. Condenser fan discharge openings shall be equipped with PVC-coated steel wire safety guards.

d. Condenser fan and motor shaft shall be corrosion resistant.

4. Compressor:

a. Compressor shall be of the hermetic scroll type .

b. Compressor shall be mounted on rubber grommets.

c. Compressors shall include overload protection.

d. Compressors shall be equipped with a crankcase heater.

e. Compressor shall be equipped with internal high pressure and high temperature protection.

5. Condenser Coil:

- a. Condenser coil shall be air-cooled and circuited for integral sub-cooler.
- b. Standard condenser coils shall have all aluminum NOVATION[®] Heat Exchanger Technology design consisting of aluminum multi-port flat tube design and aluminum fin. Coils shall be a furnace brazed design and contain epoxy lined shrink wrap on all aluminum to copper connections. Condenser coils shall be leak tested to 150 psig, pressure tested to 650 psig, and qualified to UL 199 burst test at 1980 psig. 38AUZ*25 shall be constructed of aluminum fins (copper fins optional) mechanically bonded to internal grooved seamless copper tubes which are then cleaned, dehydrated, and sealed.

6. Refrigeration Components:

- a. Refrigeration circuit components shall include liquid line service valve, suction line service valve, a full charge of compressor oil, and a partial holding charge of refrigerant.

7. Controls and Safeties:

- a. Minimum control functions shall include:
 - 1) Control wire terminal blocks.
 - 2) Compressor lockout on auto-reset safety until reset from thermostat.
- b. Each unit shall utilize the Comfort Alert[™] Diagnostic Board that provides:
 - 1) System Pressure Trip fault code indication
 - 2) Short Cycling fault code indication
 - 3) Locked Rotor fault code indication
 - 4) Open Circuit fault code indication
 - 5) Reverse Phase 3 fault code indication
 - 6) Welded Contactor fault code indication
 - 7) Low Voltage fault code indication
 - 8) Anti-short cycle protection
 - 9) Phase reversal protection
- c. Minimum safety devices which are equipped with automatic reset (after resetting first at thermostat), shall include:

1)High discharge pressure cutout.

2)Low pressure cutout.

8.Special Features:

a.Low-Ambient Temperature Control:

A low-ambient temperature control shall be provided as a factory-installed option or as a field-installed accessory. This low-ambient control shall regulate speed of the condenser-fan motors in response to the saturated condensing temperature of the unit. The control shall maintain correct condensing pressure at outdoor temperatures down to -20°F (-29°C).

b.Unit-Mounted, Non-Fused Disconnect Switch:

Switch shall be factory-installed and internally mounted. NEC and UL-approved non-fused switch shall provide unit power shutoff. Switch shall be accessible from outside the unit and shall provide power off lockout capability.

c.Louvered Hail Guard Package:

Louvered hail guard package shall protect coils against damage from hail and other flying debris.

d. Vibration Isolators:

Unit manufacturer shall provide vibration isolators for the condensing units.

2.05SINGLE DUCT VAV BOXES WITH ELECTRIC HEAT:

A. Size Range: 45 to 7100 CFM, Carrier Model Number:35EN (with 3rd Party DDC) or equal by TRANE CO.

B. SYSTEM DESCRIPTION:

1. Unit shall be a single-duct, variable air volume terminal unit with control box for installation in a ceiling that permits access to the unit. Manufacturer shall supply unit(s) of the design, number, size and performance as shown on equipment drawings and schedules. Unit(s) are for use in conjunction with air distribution manifolds, distribution ductwork and ceiling-mounted diffusers.

2. Refer to VAV Box Schedule for VAV Box airflow requirements, heater KW's, voltage, etc. for all boxes. Contractor shall assist the equipment supplier to determine the exact voltage and heater KW of the existing VAV boxes being removed in order to match the new to the existing as closely as possible.

C. QUALITY ASSURANCE:

1.Insulation shall meet NFPA 90A requirements for flame spread and smoke generation and UL 181 requirements for anti-erosion, corrosion and fungus properties.

2.Hot water coils, when specified, shall be tested for leakage at 400 psig with the coil submerged in water.

3. Electric heating coils, when specified, shall be UL or ETL listed and designed to comply with UL Standard 1096.

4. Sound power levels shall be AHRI certified in accordance with the requirements of AHRI 880.

D. DELIVERY AND STORAGE:

Units shall be stored and handled per manufacturer's recommendations.

E. EQUIPMENT

1. General:

Factory-assembled, externally powered, variable air volume control terminal. Unit shall be complete with a damper assembly, flow sensor, externally mounted volume controller, collars for duct connection and all required features. Control box shall be clearly marked with an identification label that lists such information as nominal cfm, maximum and minimum factory-set airflow limits, coil type and coil hand, where applicable.

2. Unit Cabinet:

Constructed of 22-gage (20-gage optional) galvanized steel with round or rectangular inlet collar and rectangular discharge with slip and drive connection. All primary air inlet collars shall accommodate standard flex duct sizes.

3. Insulation:

Standard cabinet insulation shall be 1/2-in. thick, 1 1/2-lb equivalent dual density fiberglass insulation that meets the requirements of UL 181 and NFPA 90A.

4. Damper Assembly:

The control air damper assembly shall be constructed of heavy gage steel with solid shaft rotating in Delrin* bearings. Damper shaft shall be marked on the end to indicate damper position. Damper blade shall incorporate a flexible gasket for tight airflow shutoff and operate over a full 90 degrees.

5. Controls:

a. Units shall have pressure-independent pneumatic, electronic, or communicating controls, as specified, capable of maintaining required airflow set points to $\pm 5\%$ of the unit's capacity at any inlet pressure up to 6-in. wg. The controllers shall be capable of resetting between factory or field-set maximum and minimum (>350 fpm inlet duct velocity) set points to satisfy the room thermostat demand.

b. The unit shall be equipped with an amplified linear averaging flow probe located across the inlet. The sensor will provide a differential pressure signal amplified to equal 3 times the velocity pressure with an accuracy of at least $\pm 10\%$

throughout the range of 350 to 2600 fpm inlet duct velocity, depending on the controller employed.

6. Special Features:

a. Electric Heating Coil: Electric coils shall be mounted in a minimum 20 gage zinc coated steel casing and shall be UL listed. Coils shall have:

- 1) Elements shall be nickel chrome and supported by ceramic isolators.
- 2) The integral control panel shall be housed in a NEMA 2 enclosure, with hinged access door for access to all controls and safety devices.
- 3) Electric coils shall contain a primary automatic reset thermal cutout and differential pressure airflow switch for proof of airflow (optional).
- 4) Electric coils shall include fused or nonfused door interlocking disconnect switch, mercury contactors, fuseblock, dust tight enclosure construction, all mounted and/or wired within the control enclosure.
- 5) Heaters shall be designed for the capacity, electrical characteristics and steps of control as shown on the equipment schedule.
- 6) Coils are factory-wired and include all limit switches.
- 7) An SSR (solid-state relay) proportional heat control shall meet the requirements of ASHRAE Standard 62, Addendum N.

b. Sound Attenuator: The sound attenuator section shall consist of a continuous extension of the standard zinc coated steel casing. When electric heat is required, the attenuator will be used.

c. Control Transformers:

- 1) Electric heat units shall include a factory supplied, mounted and wired control transformer inside the electric heat enclosure for electronic control applications.
- 2) Non-electric heat units, with electronic controls, shall be available with an optional factory supplied, mounted, and wired control transformer, mounted inside the control enclosure.

d. Access Panel: An access panel in the terminal unit casing shall be available for viewing damper components.

e. Non-Fused Disconnect: Non-fused switch shall provide unit power shutoff. Shall be accessible from outside the unit and shall provide power off lockout capability.

2.06 ELECTRIC DUCT HEATERS:

A. Furnish and install in air handler ductwork systems as indicated on the plans, electric duct heater(s) of size, type and capacity as specified below.

B. Size: 6 through 12 KW, 2 stage, 460 volt, 3 phase (New replacement duct heaters shall match existing heater voltages and KW's. Contractor shall field verify all heater characteristics prior to ordering heaters.)

C. Duct heater shall be furnished complete with a sheath finned type electrical heating elements, heavy gauge aluminized steel frame, "slip-in" or flanged for duct mounting as applicable, stainless steel terminal studs and hardware, phenolic terminal bushings, single set of terminals for incoming power lines, built-in set of fuses for each heater circuit protecting all ungrounded conductors, insulated terminal box mounted on end of duct heater with a hinged latch cover, built-in mercury contactor for each heater circuit that will disconnect all ungrounded conductors, built-in "backup" magnetic contactor that will disconnect all ungrounded conductors in the incoming power lines, all heater circuits equal in size, each heater circuit a balanced three phase load, automatic reset type high limit thermal cutout, manual reset type high limit thermal cutout to operate the "backup" contactor specified above, built-in control circuit transformer with fused primary windings, air flow switch for protection against air failure, wiring diagram, complete heater assembly listed by UL, and all heater components completely assembled and pre-wired at the factory. Duct heater shall comply in all respects with the latest National Electrical Code.

D. Provide a new electrical disconnect switch for each heater.

E. Interlock each heater with its respective air handler fan, so that heater will be de-energized whenever the unit fan is shut down.

F. All heaters shall be designed for vertical mounting for horizontal airflow. Control panel access doors for replacement heaters shall match door locations of existing heaters.

G. Do not install heater in lined ductwork.

H. Electric duct heater shall be as manufactured by INDEECO CO., WARREN CO., TUTCO CO., ELECTRIC HEATERS CO., , or approved equal.

2.07 DUCTLESS MINI-SPLIT AIR CONDITIONING SYSTEM (COOLING ONLY):

A. Furnish and install where indicated on the plans, ductless split system heat pump(s) of size, type and capacity as scheduled on the drawings. The minimum SEER rating for all equipment shall be 13.0.

B. The indoor unit (ductless air handler) shall be furnished in one of the following configurations as indicated on the plans: high wall mount or ceiling suspended. Each air handler shall be furnished complete with a molded plastic composite cabinet assembly with adjustable discharge vanes, return air filters, insulated casing interior, insulated drain pan, blower section, three speed fan motor with built-in overload protection for fan motor, direct expansion indoor coil section with condensate drain fitting, electronic wired remote control cooling thermostat, built-in disconnect switch, air-conditioning unit controls, unit assembled and pre-wired at the factory, and other controls and accessories as applicable for a complete installation.

C. The outdoor condensing unit shall be furnished complete with a baked enamel steel casing, fan motor, magnetic starter or built-in overload protection for fan motor, outdoor coil section, coil guard, compressor with 5 year factory warranty, compressor overload protection, starting capacitor and relay where required, low ambient temperature controls for cooling operation

down to 0°F., time guard circuit, refrigerant thermal expansion valve, service valves, liquid line filter-drier, crankcase heater, standard air-conditioning controls, unit assembled and pre-wired at the factory, and other controls and accessories as applicable for a complete installation. The unit shall utilize R-410A refrigerant. System shall be capable of auto-restart after power interruption and capable of being start/stopped from a building central control system.

D. The equipment manufacturer or his authorized dealer shall provide factory start-up service for the ductless indoor and outdoor unit as required. Submit record copies of the start-up report to the Owner.

E. Ductless mini-split air conditioning systems shall be CARRIER CORP., ENVIROMASTER INC. or approved equal.

2.08 DUCTWORK:

A. Ductwork shall be run as indicated on drawings. Verify actual conditions and space constraints before fabricating any ductwork. Careful coordination with existing conditions to avoid conflicts with ceiling systems, sprinkler piping, plumbing piping, conduits, cable trays, computer wiring, structural framing, etc.

B. Unless otherwise noted, all new supply, return and outside air ductwork shall be constructed of galvanized steel with conventional seams and joints, sealed airtight with high-pressure duct joint sealer. Gauges of all galvanized steel ductwork shall comply with SMACNA Sheet Metal Duct Construction Standards. All sheet metal ductwork shall be fabricated and installed in accordance with the latest SMACNA Sheet Metal Duct Construction Standards. All new ductwork shall be externally insulated with duct wrap insulation specified hereinafter.

C. When new ductwork is connecting to existing fiberglass ductboard systems, the new ductwork shall be sheet metal with duct wrap insulation as specified above.

D. Provide reinforcing and supports for ductwork per SMACNA.

E. Support sheet metal ductwork with approved type straps, rods, or angle iron of adequate size secured to building construction as required.

F. Round flexible ductwork shall be THERMAFLEX CO. Type M-KE insulated double air seal round flexible "Fiberglas" air duct with a 1" thickness, bi-directional reinforced metallized vapor barrier with triple ply stand-up seam, acoustically rated black CPE liner permanently bonded to a coated spring steel wire helix that supports the "Fiberglas" blanket insulation, round duct diameters as specified on plans, and duct lengths as required to meet job conditions. Flexible ductwork run outs shall be limited to a maximum length of 6 feet with any additional length made-up of round sheet metal ductwork with duct wrap insulation specified hereinafter. Attach round flexible ductwork to rectangular ductwork with "Twist-Lok" takeoff fittings with air scoops and balancing dampers. All flexible ductwork connections to "Twist-Lok" fittings and air distribution equipment shall be made using stainless steel worm gear clamps. Plastic panduit straps are not acceptable.

G. Install double vane type turning vanes at all square elbows in the ductwork. Dampers, turning vanes, and other items to be installed in conjunction with the ductwork are specified in subsequent paragraphs.

H. Duct dimensions shown on drawings are inside dimensions. Follow duct dimensions indicated on drawings as closely as possible. Provide offsets, vary shape or alter run if required to accommodate structural or other interferences. Where shape of duct varies, alter dimensions to provide equal static pressure drop per unit length.

I. Cover or otherwise protect all fan and duct openings from dirt and debris during construction. Clean systems prior to final inspection.

J. Cap daily all open ends of duct systems during construction to reduce dust and debris buildup in ductwork.

2.09 FLEXIBLE DUCT CONNECTORS:

A. Where equipment is supplied with internal flexible duct connectors, external flexible duct connectors are not required. Otherwise, all sheet metal ductwork connections to each piece of air handling equipment shall be made with a glass fabric flexible duct connector equal to "Ventglas" for indoor applications and "Ventlon" for outdoor use as manufactured by VENTFABRICS CO. Each flexible duct connector shall be non-combustible, double-coated with fire retardant neoprene, airtight, waterproof, designed for medium pressure ductwork, and UL approved.

2.10 REFRIGERANT AND CONDENSATE DRAIN PIPING:

A. Provide galvanized steel pipe sleeves for piping wherever it passes through masonry partitions, walls, and floors. Seal openings between sleeves and pipes using 3M Brand fire protection products specifically approved for the particular usage, and installed in strict accordance with the manufacturer's recommendations. Where pipes pass through fire rated partitions seal penetrations as indicated on the details on the drawings.

B. Install chrome plated floor and ceiling plates around piping wherever it passes through walls, floors, ceilings, partitions, and equipment cabinets in exposed locations. F. & C. plates shall be CRANE CO. No. 10-BC and No. 13-BC plates, or equals by GRINNELL CO. or BEACON AND CADWELL CO.

C. Refrigerant Piping:

1. All refrigerant piping shall be Type "L" ACR cleaned and capped hard drawn copper piping with soldered wrought copper fittings, using silver solder, "Sil-Fos", or "Phos-Copper". Piping shall be installed plumb and level as applicable. All elbows in piping shall be made with long radius elbows.
2. All refrigerant piping shall be capped with copper caps soldered or brazed to each end of the piping during construction to reduce the possibility of introducing dirt, moisture or debris into the refrigerant systems. Duct tape is not acceptable as a means to cap piping.

3. Notify the Engineer for an inspection whenever refrigerant piping, which is to be installed below grade or below floor slabs, has been roughed-in prior to covering up trenches.
4. Contractor shall consult the equipment manufacturer for sizing of the refrigerant piping once exact routing has been determined. Contractor shall furnish equipment manufacturer with all pertinent information such as length of piping, number of elbows, elevations of equipment, etc. necessary for proper sizing of piping and installation of equipment. Contractor shall install all fittings, traps, oil loops, accumulators, expansion valves, solenoid valves, etc. as recommended by the unit manufacturer for this specific equipment/piping installation.
5. Isolate refrigerant piping at all condensing units using Style BF "Spring-Flex" bronze seamless corrugated hoses with bronze braiding, copper tube sweat ends and lengths as recommended by the vibration isolator manufacturer.

D. Condensate Drain Piping:

1. Condensate drain piping located below floor slabs and below grade outside building shall be a minimum of 2-inch Schedule 40 PVC pipe and fittings with glued joints. Provide cleanouts flush to grade in each below grade line where the pipe exits the exterior wall.
2. Condensate drain piping located inside the building, above ceilings, in walls and exposed above grade shall be Type "L" hard drawn copper. Connections shall be made with soldered wrought copper fittings, using 95-5 solder. Each drain line shall be full size of the drain connection on the unit (minimum) and shall have a 2-inch deep trap with a water seal. Provide cleanouts with removable threaded plugs in piping where indicated on drawings. Extend the condensate drain line to the nearest roof drain, floor drain, janitor's closet, gravel box, etc. as indicated on the plans. Drain piping shall maintain a minimum 1" per 10' pitch.

2.11 PIPE PORTALS:

A. Furnish and install pipe portal systems where the refrigerant piping and conduits pass through the roof deck of the building. Pipe portal systems shall be furnished complete with a roof curb, laminated acrylic coated ABS plastic curb cover with pre-punched mounting holes and a molded sealing ring on an 8" collared opening, EPDM Style N28 compression molded rubber cap, and two pairs of stainless steel clamps. Roof curb shall be of 18 gauge galvanized steel construction with wood nailer, built-in cant, and 1-1/2" thick 3-pound density fiberglass insulation.

B. Pipe portals shall be as manufactured by IMPERIAL METALS, ROOF PRODUCTS & SYSTEMS or approved equal.

2.12 PIPE HANGERS AND SUPPORTS:

A. Furnish and install pipe hangers and supports as specified below, or similar products as manufactured by GRINNELL CO., FEE AND MASON CO., ELCEN CO., or approved equal.

B. Install pipe hangers and supports as required by the INTERNATIONAL PLUMBING CODE and as required to prevent undue strains and stresses on piping systems and pieces of

mechanical equipment and as required to make provisions for expansion, contraction, and structural settlement.

C. Piping supports shall be designed and installed for the seismic forces as required in the INTERNATIONAL BUILDING CODE.

D. Support horizontal steel pipes and insulated copper pipes by means of split ring pipe hangers with adjustable swivels equal to GRINNELL CO. Figure 104, furnished in plated malleable iron, or adjustable galvanized clevis hangers equal to GRINNELL CO. Figure 206, or cast iron pipe stanchion saddle with steel yoke and nuts equal to GRINNELL CO. Figure 259.

E. Spacing for all hangers and supports for horizontal and vertical piping shall comply with the INTERNATIONAL PLUMBING CODE.

F. Support horizontal insulated and un-insulated Schedule 40 PVC pipes with adjustable clevis hangers equal to GRINNELL CO., Figure 65, furnished with insulation shields for insulated pipe.

G. Support vertical steel pipe risers with GRINNELL CO. Figure 139 split ring extension hangers or Figure 261 riser clamps, furnished in black malleable iron.

H. Support vertical insulated copper risers with GRINNELL CO. Figure 139 split ring extension hangers or Figure 261 riser clamps, furnished in black malleable iron.

I. Support vertical bare copper risers with split ring extension hangers equal to GRINNELL CO. Figure CT-130 or ELCEN Figure 398, furnished with a copper plated finish.

J. Where pipes must be run tight against steel beams and structural members provide trapeze type hangars with pipe clamps to secure pipes. Spacing for trapeze hangars shall be same as listed above for smallest pipe on trapeze.

K. Provide a protector saddle equal to FEE AND MASON CO. Figure 80 at each pipe hanger location for all insulated piping. Oversize pipe hangers so that they will extend around the pipe insulation and the protector saddles.

L. Furnish and install all supplementary steel, framing members, beam clamps, hanger rods, inserts, structural piping, angle iron, channels, etc., as required to properly support all piping and pipe hangers.

2.13 INSULATION:

A. All insulation shall be installed in a workmanlike manner by qualified insulation mechanics in regular employ of a licensed Insulation Contracting Firm working in the capacity of a subcontractor under the H&AC Contractor. Install all insulation in strict accordance with the manufacturer's recommendations, using approved type laggings, adhesives, mastics, and other materials as applicable.

B. General:

1. Unless otherwise indicated, all insulation materials shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less as measured by the ASTM E-84 test.
2. Laggings, adhesives, and mastics for the various insulating materials shall be as specified below, or similar products as manufactured by LION OIL CO., INSULMASTIC CO., BENJAMIN FOSTER CO. or approved equal.
3. Insulation shields are required at all hangers supporting piping. Wherever required to prevent pipe hangers from crushing the fiberglass insulation, install a short section of cellular glass insulation at each pipe hanger location. Vapor seal joints between fiberglass and cellular glass insulation with vapor barrier mastic.
4. Provide a .016" thick aluminum jacket for all pipe insulation exposed to the weather.
5. All black steel chilled water piping located above grade outside the building shall be coated with a heavy coat of "Bitumastic 50" before piping is insulated to prevent external corrosion of the piping.
6. The H&AC contractor shall install all pipe heating tapes on mechanical water piping exposed above grade at the various pieces of equipment before pipe insulation is applied by the Insulation Contractor.
7. Mechanical Contractor shall repair pipe insulation as required where insulation is disturbed in order to install new piping mains, runouts, drains, valves, fittings, etc. for the installation of new equipment and materials. Contractor shall also repair, at not additional cost, any insulation damaged during the demolition of existing mechanical equipment and materials and the installation of new equipment and materials.

C. Pipe Insulation Materials:

1. The thermal conductivity of all insulation materials shall range from 0.22 to 0.28 Btu-in / (hr-sf-°F.). For insulating materials outside the conductivity range, the minimum thickness shall be increased to provide an equivalent overall "U" value.
2. Armaflex type pipe insulation shall be ARMSTRONG INSULATION's "AP Armaflex SS", or approved equal, a flexible closed-cell elastomeric foam. Joints and seams shall be sealed with Armstrong 520 Adhesive. Insulate all elbows and fittings with mitered segments of pipe insulation sealed with adhesive specified above. Insulation shall not be stretched (under tension) at joints and seams.
3. Fiberglass type pipe insulation shall be OWENS-CORNING's SSL-II, UL rated "Fiberglas 25 ASJ", or approved equal, consisting of a fiberglass heavy density sectional pipe insulation with a noncombustible vinyl coated embossed vapor barrier laminate all service jacket secured with a pressure sealing double adhesive lap seal. Vapor seal end joints with joint sealing strips secured with pressure sealing adhesive. Insulate fittings with mitered segments of fiberglass pipe insulation or molded insulation fitting covers. Secure insulation to fittings as required and finish with insulating cement, "Fiberglas" reinforcing cloth, and fitting mastic as recommended by the manufacturer.
4. Cellular glass thermal type pipe insulation shall be PITTSBURGH CORNING's "Foamglas" or approved equal with two layers of glass fabric jacket secured with 16 gauge copper wire on 9" centers. Vapor seal all seams and joints and cover glass fabric jacket with two heavy coats of LION OIL CO. "Seal-Kote" mastic, or equal, as required for a watertight installation. Finish insulation exposed above grade with .016" thick aluminum jacket and mitered aluminum elbows or molded PVC elbows.

D. Insulation for Refrigerant and Condensate Drain Piping:

1. Insulate new refrigerant suction and vapor piping outside the building and on roofs using 1" thick Armaflex pipe insulation. Finish insulation exposed above grade outside building with .016" thick aluminum jacket and molded PVC elbows.
2. Insulate new refrigerant suction and vapor piping inside the building using 1" thick Armaflex pipe insulation.
3. Insulate condensate drain piping inside the building using ¾" thick Armaflex pipe insulation.
4. Pipe hangers and supports for piping shall be oversized so that hangers will extend completely around the pipe insulation and the protector saddles as specified elsewhere.
5. Provide rigid insulation at each vertical pipe support so as to not compress insulation and to maintain a continuous vapor seal. Vapor seal all joints between rigid pipe insulation and compressible type insulation such as "Armaflex" and "Foamglas".

E. Duct Wrap Insulation:

1. Sheet metal supply, return and outside air ductwork shall be insulated using OWENS-CORNING CO. Commercial Grade Series 100 "Fiberglas" duct wrap insulation with FRK vapor barrier jacket, 1 pound density, and (2" thick), 1½" applied thickness with a minimum installed "R" value of 6.0. Apply insulation to ductwork with 4" strips of insulation binding adhesive at 8" on centers and with mechanical fasteners as recommended by the manufacturer. Overlap joints at least 2", and secure with staples on 6" centers. Strip all seams and joints with glass fabric tape, and seal with fire resistant vapor barrier mastic equal to MM-225.

F. Ductwork Liner Insulation:

1. Insulate the interior of supply and return when indicated on drawings using 1" thick, Type 300 (minimum R-3.5), flexible "Fiberglass" insulation. Apply duct liner to interior of sheet metal ductwork using 100% coverage of vapor barrier adhesive and using mechanical fasteners as recommended by the insulation manufacturer. Liner shall be interrupted at the area of operation of a fire damper and 6" upstream and 6" downstream of electric-resistance and fuel-burning heaters in the duct system. Metal "nosings" or sleeves shall be installed over exposed duct liner edges that face opposite the direction of airflow. Provide duct wrap type insulation at all interruptions in the duct liner installation.

PART 3 - EXECUTION

3.01 LABELING OF EQUIPMENT:

A. All mechanical items of equipment installed under this contract shall be permanently labeled with Bakelite or bronze nameplates for identification purposes. Nameplates shall be securely attached to the respective items of equipment and the numbering sequence of the various items shall correspond with the numbering sequence used on the mechanical drawings. Unit mounted labels for refrigerant containing equipment shall comply with the Standard Fire

Prevention Code Chapter 28. Approved manufacturers are SETON NAME PLATE, T&B/WESTLINE PRODUCTS or BRADY.

B. Equipment (VAV boxes and electric duct heaters) installed above “lay-in” type ceilings shall have their locations identified with nameplates secured to the ceiling grid bars. Type of nameplates and labeling shall be approved by the Owner.

3.02 ELECTRICAL WORK:

A. The Electrical Contractor working as a sub-contractor under the Mechanical Contractor will provide the following for the mechanical equipment:

1. A source of power as required for each electric motor and for each electrical heating and cooling item of equipment installed under the mechanical contract, including final wiring connections to motor terminals or to terminals in a control panel mounted on each respective unit.
2. Circuit breaker protection as required for each electric motor and for each electrical heating and cooling item of equipment installed under the mechanical contract.
3. Wiring each electric motor and each electrical heating and cooling item of equipment (where applicable) through a magnetic starter or a magnetic contactor furnished by the H&AC Contractor.
4. Disconnecting existing electrical wiring from existing mechanical equipment being replaced and reconnecting power, through new disconnects to the new equipment. New disconnect switches shall be furnished by the equipment manufactures or electrical contractor. Coordinate with the Mechanical Contractor.
5. A new source of power (including wiring, conduits, breakers, disconnects, etc.) for the new VAV box with electric heat – VAV-23.
6. A new source of power (including wiring, conduits, breakers, disconnects, etc.) for the new ductless mini-split indoor and outdoor units, DAC-1.

B. Should the H&AC Contractor propose to use any item of mechanical equipment that has different electrical requirements from those specified in these specifications or indicated on the drawings or elsewhere, the Contractor shall be responsible for coordinating these changes with his Electrical Sub-Contractor, and he shall reimburse the Electrical Contractor for all additional costs necessitated by these changes.

C. In general, the Electrical Contractor will do all power wiring for the mechanical equipment as described above, and the H&AC Contractor shall do all control and interlock wiring, unless otherwise specified or indicated on the drawings.

D. Consult the drawings (new and existing) to determine the exact extent of electrical work provided for the mechanical equipment. Verify the current characteristics with the Electrical Contractor before ordering any equipment for this project. Failure to confirm voltage requirements for mechanical equipment with the electrical contractor shall result in the H&AC

Contractor bearing any cost associated with changes stemming from incorrect voltages on this project.

E. H&AC Contractor shall furnish and install all other wiring, not covered above, that is necessary for a complete and operating heating and air conditioning system for the building(s), including all control wiring, interlock wiring, conduit, relays, controls, starters, disconnect switches, circuit breakers, control conduit and outlet boxes, wiring of all applicable control items of equipment, and other electrical work as required.

F. All wiring shall be run in galvanized or sherardized rigid electrical conduit or in EMT where allowed under the Electrical section of the specifications, and shall be concealed in finished areas and occupied spaces, unless otherwise approved by the Architect. Wiring shall have Type THW insulation, and shall be No. 12 AWG minimum for power wiring and No. 16 AWG minimum for control wiring. Seal all openings around electrical conduit located in partitions, walls and floors using 3M Brand fire protection products specifically approved for the particular usage and fire rating (where applicable), and installed in strict accordance with the manufacturer's recommendations.

G. All electrical work required under this contract shall comply with the latest edition of the National Electrical Code, and shall meet all local requirements. All electrical equipment shall bear UL labels where applicable.

H. All starters for the mechanical equipment shall be furnished with "Hand-Off-Automatic" devices so that the various items of equipment may be operated manually or automatically as desired. Each starter shall also be furnished with motor overload protection in each electrical power phase to provide full protection for the respective electric motor.

3.03 BUILDING TEMPERATURE CONTROLS:

A. Control Management Inc. (CMI) in Columbia, SC shall furnish and install a complete system of electronic DDC automated building temperature controls under a separate contract with the Owner. CMI shall provide all necessary control devices, thermostats, sensors, hardware, software, programming, etc. for all new mechanical items of equipment installed under this contract.

B. The Mechanical Contractor shall coordinate mechanical requirements with the Controls Contractor by providing copies of the HVAC unit submittals, wiring diagrams, etc. and other pertinent information as applicable.

C. The Mechanical Contractor shall provide the Control Contractor with anticipated schedules for equipment replacements.

3.04 PERFORMANCE TESTS:

A. Testing and balancing of the air systems shall be done by an independent test and balance agency as specified in a subsequent paragraph.

B. The contractor shall furnish competent personnel and necessary testing instruments and equipment to check, test, operate and balance the mechanical systems as installed. Tests shall

be of sufficient duration to prove adequacy and satisfactory performance of all items of equipment.

C. Clean all equipment and nameplates, and lubricate all motors and bearings as required.

D. The H&AC contractor shall provide temporary air filters in all equipment upon initial start-up. These filters shall be replaced or cleaned regularly for as long as the equipment is in operation. One clean set of air filters furnished by the various equipment manufacturers shall be installed inside the respective mechanical items of equipment just prior to final inspection, and all extra sets of air filters shall be delivered to the Owner prior to final acceptance of the project.

E. The Owner's Control Contractor shall adjust and set all thermostats and other control items of equipment as required. The Control Contractor shall insure that all control items of equipment related to the new mechanical equipment have been installed, calibrated, programmed and are operating properly.

F. Furnish to the Owner record copies of all mechanical unit start-up service reports.

G. Adjust and set with instruments the specified air quantity at each register, grille and diffuser in the building as applicable and as required to maintain relatively uniform space temperatures throughout the areas of each zone. Record data and submit copies of test and balance reports to the Owner.

H. Adjust and set with instruments the specified air quantity at outside air damper. Record data and submit copies with the test and balance reports to the Owner.

I. Check all safety devices on air handlers, condensing units, VAV boxes and electric duct heaters to determine that they are functioning properly.

3.05 TRAINING OWNER'S PERSONNEL:

A. The contractor shall furnish the services of a competent engineer or mechanic to thoroughly train and instruct the Owner's personnel in the proper operation and maintenance of all mechanical items of equipment installed under this contract.

B. The contractor shall obtain and deliver to the Owner and Engineer copies of the following statement signed by the Owner's maintenance Superintendent or his authorized representative:

"This is to certify that our personnel have been thoroughly trained and instructed in the proper operating and maintenance procedures for all mechanical equipment installed under this contract."

Signed: _____

Title: _____

Date: _____

3.06 TESTING AND BALANCING OF MECHANICAL SYSTEMS:

A. The H&AC Contractor shall employ the services of a licensed independent Testing and Balancing Agency, which is NEBB or AABC certified, to do all testing and balancing of the air systems installed under this contract as specified below and as required. Test and Balance procedures shall comply with ASHRAE Standard 111.

B. Work to be performed by the Testing and Balancing Agency shall include but is not necessarily limited to the following items:

1. Adjust and record the supply air, return air and outdoor air quantities for each new air handler system installed under this contract.
2. Check and record the inlet and outlet static pressures for each new air handler system installed under this contract.
3. Adjust and record the minimum and maximum air quantities for all new VAV boxes.
4. Record the entering and leaving air temperatures for each new air handler/condensing unit system. Record these temperatures for each system in both the heating and cooling cycle as applicable.

C. Testing and balancing report for each mechanical unit shall include the equipment manufacturer, model number, serial number, nameplate amperage and actual running amperage for each motor, design and actual air quantities, temperatures and static pressures as listed above, spaces served by the mechanical unit and other pertinent data as applicable.

D. Submit record copies of all testing and balancing reports for the air systems to the Owner. Copies of these reports shall also be included in the Operation and Maintenance Manuals.

3.07 OPERATION AND MAINTENANCE MANUALS:

A. The contractor shall furnish the Owner two complete sets of Operation and Maintenance Manuals containing the following data neatly compiled and indexed in hard cover 3-ring binders:

1. Shop drawings, specification sheets and/or descriptive literature on all equipment and materials installed under this contract.
2. Operating and maintenance instructions for all mechanical items of equipment installed under this contract. Compile manufacturer's information into a weekly/monthly/yearly maintenance and lubrication schedule for all mechanical equipment. Include information such as bearing type, lubrication type, belt size, etc. and safety precautions where applicable.
3. Name, address and telephone number of supplier for each mechanical item of equipment.
4. Name, address and telephone number of persons to contact for service on mechanical equipment.

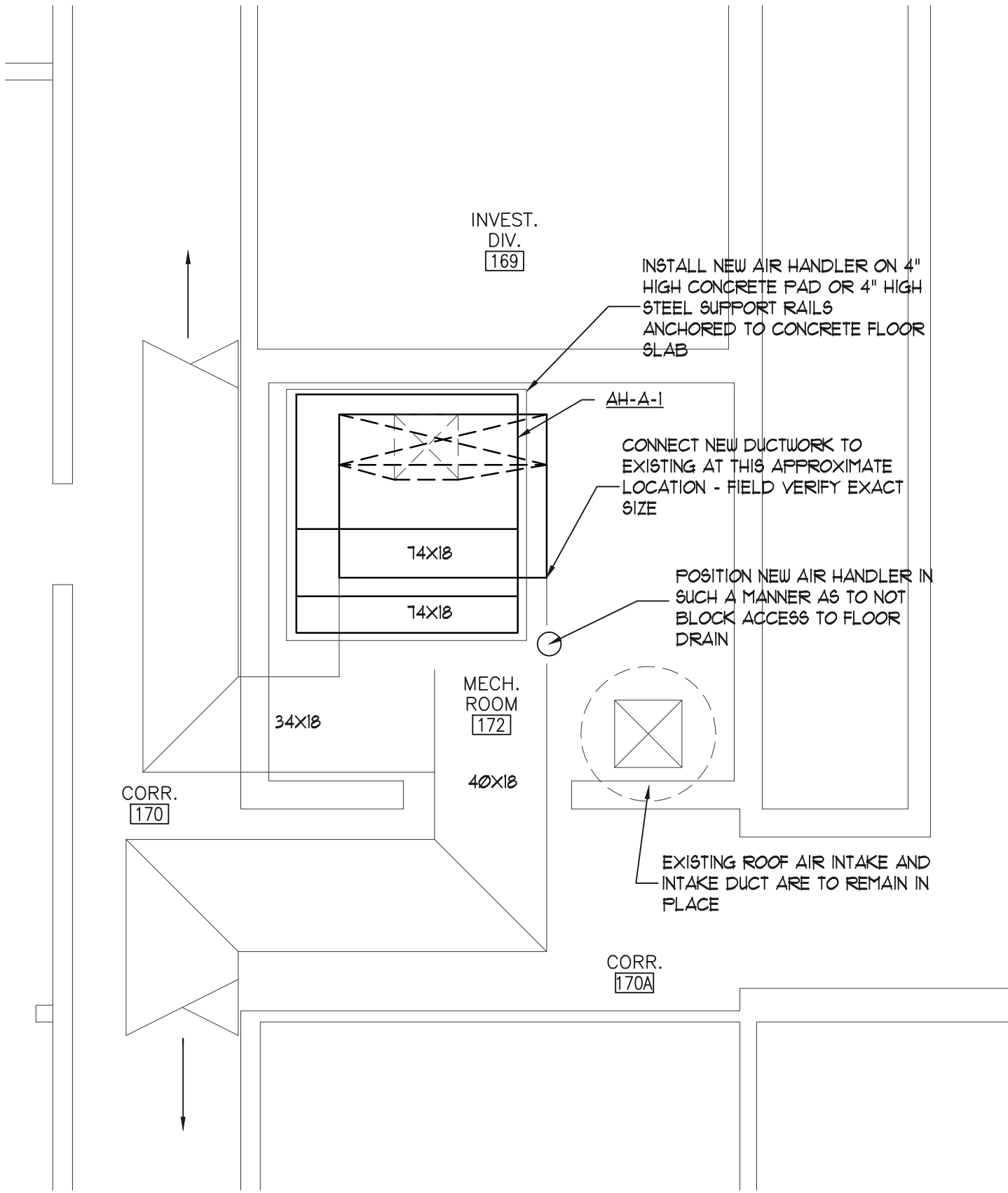
5. Manufacturers' written warranties for all applicable mechanical items of equipment.
6. "As-Built" drawings (as applicable).
7. Start-up service reports for all new equipment installed under this contract.
8. Test and balance reports.

3.08 GUARANTEES:

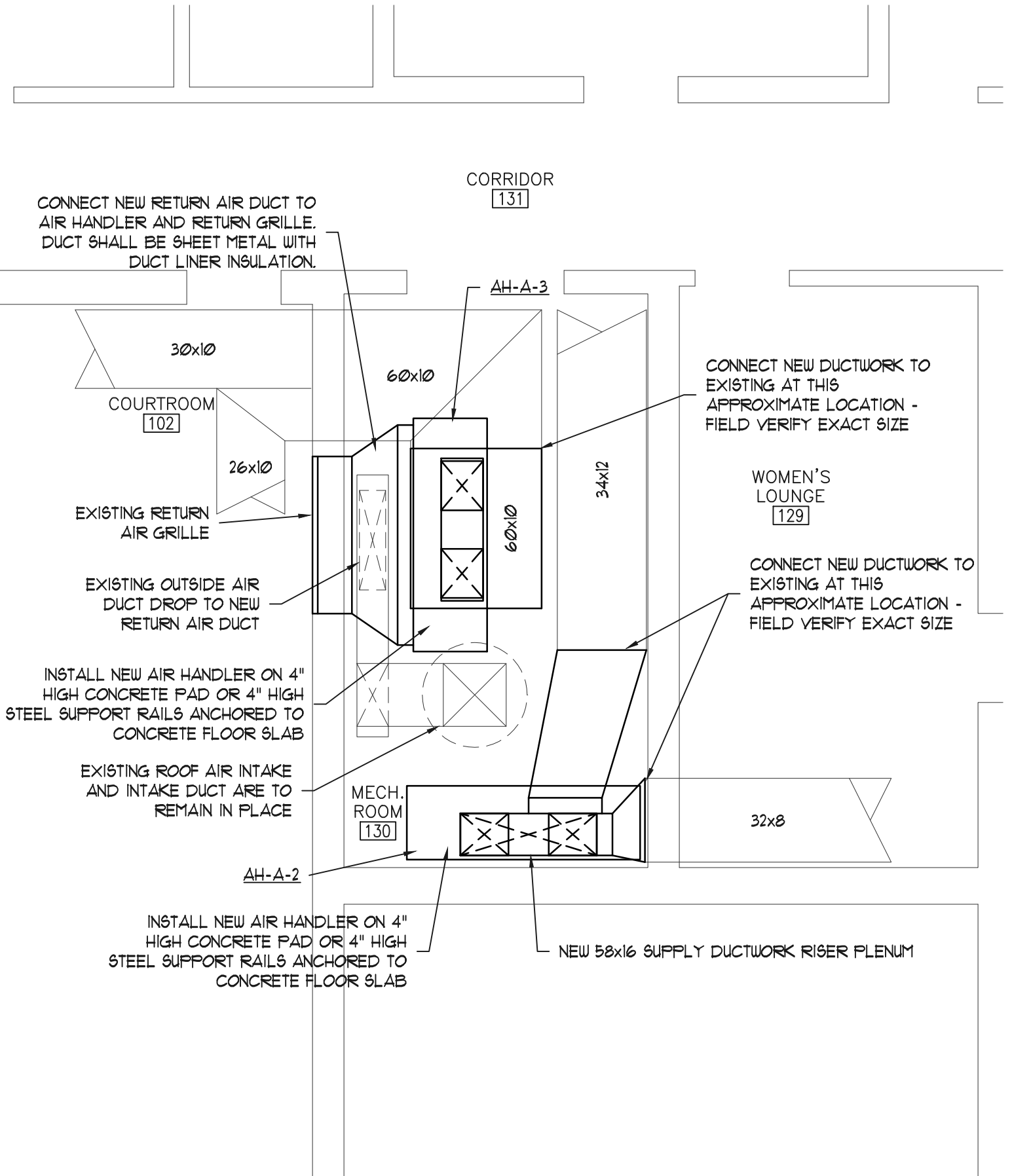
A. Unless otherwise specified above, the H&AC Contractor shall guarantee that all equipment, materials and workmanship covered by this contract shall be free from defects of any nature for a period of one year from the date of acceptance of the installation by the Owner. He shall guarantee that all equipment and materials as installed by him meet specified capacities, ratings and quality standards.

B. The contractor shall service all equipment installed by him under this contract for a like period of one year. (Filter replacements during the warranty period are the responsibility of the Owner.)
\

C. The contractor shall guarantee the mechanical system as installed by him to operate quietly, safely and efficiently.



MECHANICAL ROOM 172 PLAN
 NOT TO SCALE



CONNECT NEW RETURN AIR DUCT TO AIR HANDLER AND RETURN GRILLE. DUCT SHALL BE SHEET METAL WITH DUCT LINER INSULATION.

CORRIDOR
131

CONNECT NEW DUCTWORK TO EXISTING AT THIS APPROXIMATE LOCATION - FIELD VERIFY EXACT SIZE

WOMEN'S LOUNGE
129

CONNECT NEW DUCTWORK TO EXISTING AT THIS APPROXIMATE LOCATION - FIELD VERIFY EXACT SIZE

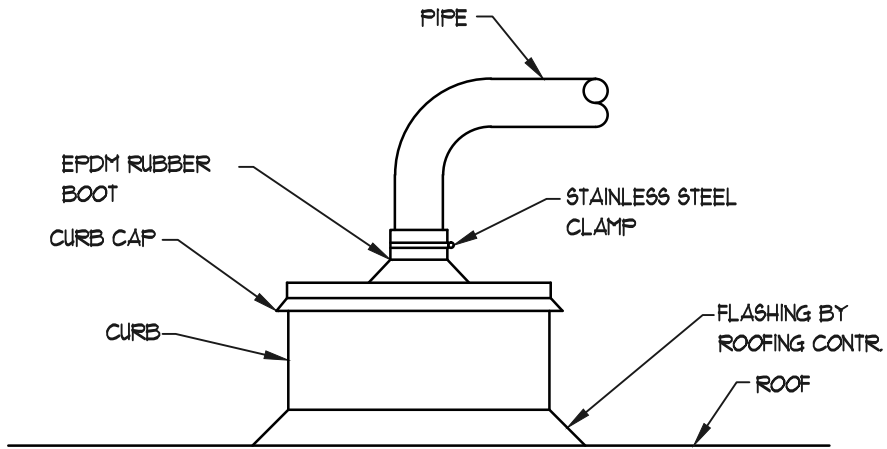
INSTALL NEW AIR HANDLER ON 4" HIGH CONCRETE PAD OR 4" HIGH STEEL SUPPORT RAILS ANCHORED TO CONCRETE FLOOR SLAB

EXISTING ROOF AIR INTAKE AND INTAKE DUCT ARE TO REMAIN IN PLACE

NEW 58x16 SUPPLY DUCTWORK RISER PLENUM

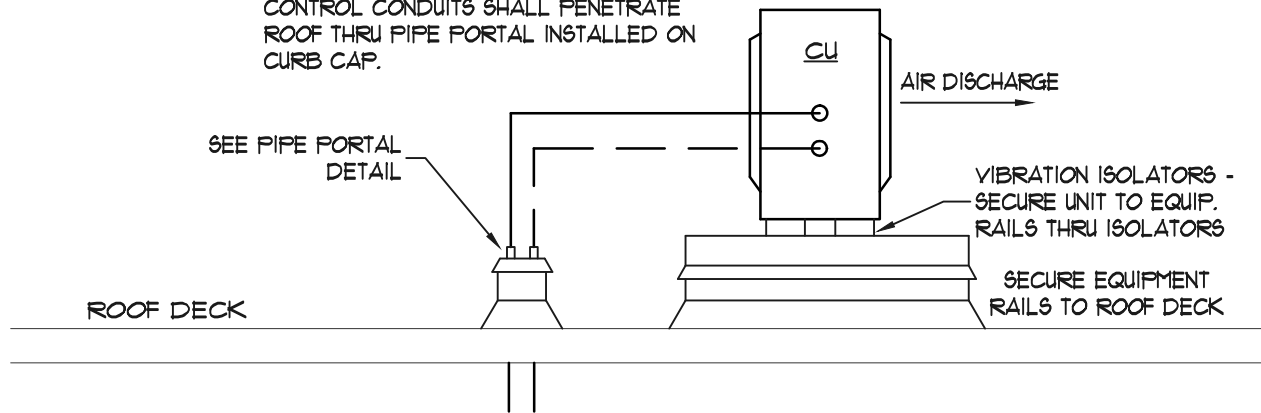
INSTALL NEW AIR HANDLER ON 4" HIGH CONCRETE PAD OR 4" HIGH STEEL SUPPORT RAILS ANCHORED TO CONCRETE FLOOR SLAB

MECHANICAL ROOM 130 PLAN
NOT TO SCALE

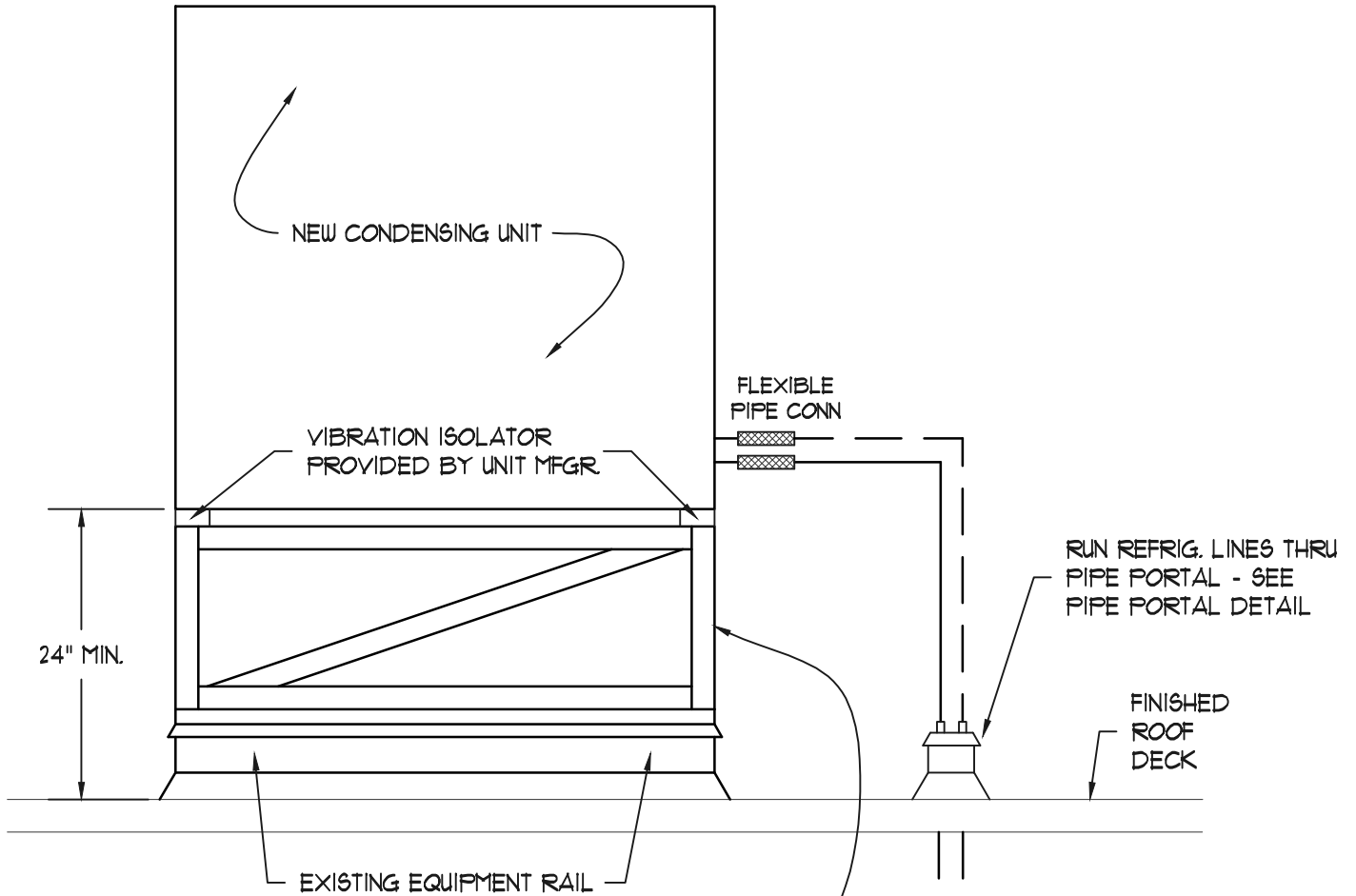


PIPE PORTAL DETAIL
NOT TO SCALE

NOTE:
REFRIGERANT PIPING AND ELECTRICAL AND
CONTROL CONDUITS SHALL PENETRATE
ROOF THRU PIPE PORTAL INSTALLED ON
CURB CAP.

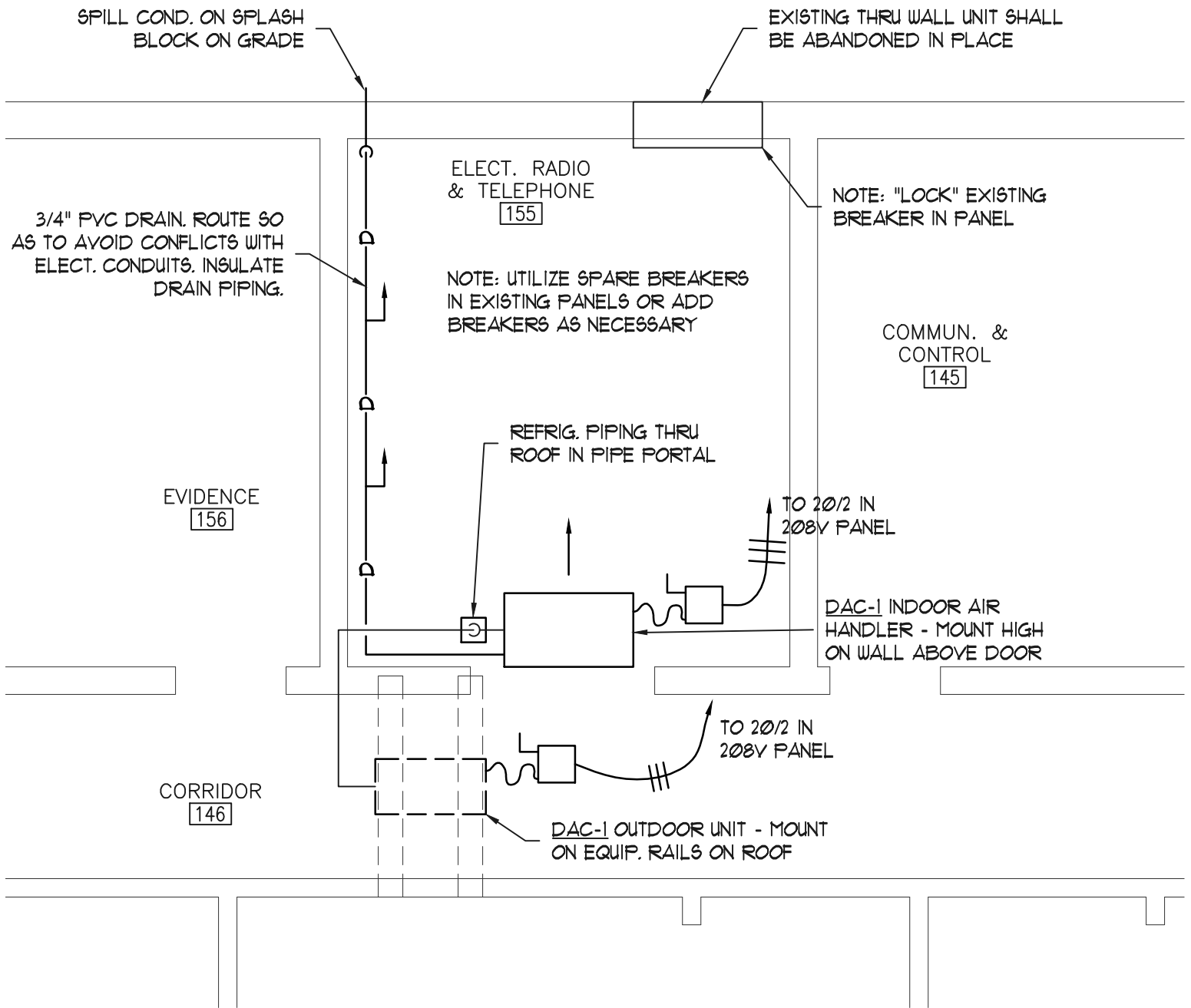


**DUCTLESS OUTSIDE UNIT
INSTALLATION DETAIL**
NOT TO SCALE

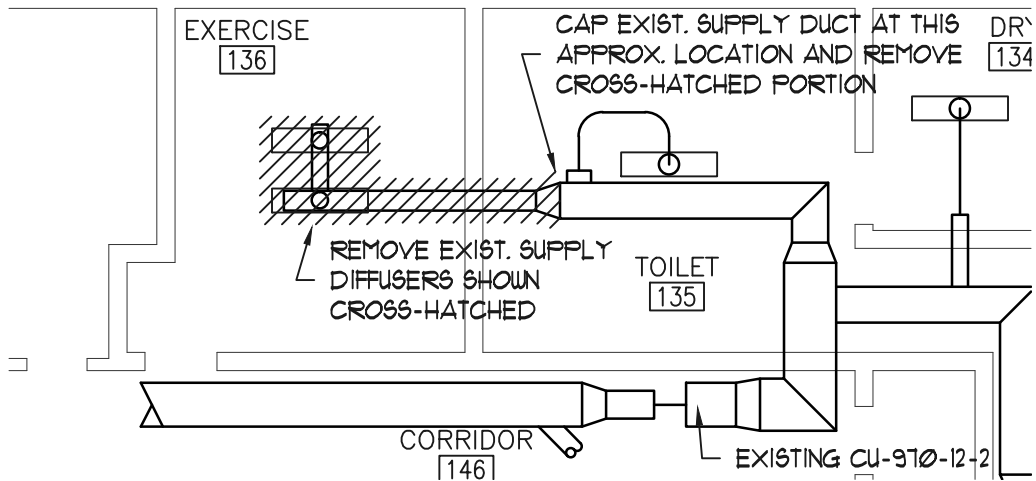


CONTRACTOR SHALL FABRICATE A STRUCTURAL STEEL FRAME TO SUPPORT NEW CONDENSING UNIT. FRAME SHALL BE SECURED TO EQUIP. RAILS AND PROVIDE CONTINUOUS SUPPORT UNDER CONDENSING UNIT BASE RAILS. BOLT CONDENSING UNIT TO SUPPORT FRAME THRU VIBRATION ISOLATORS.

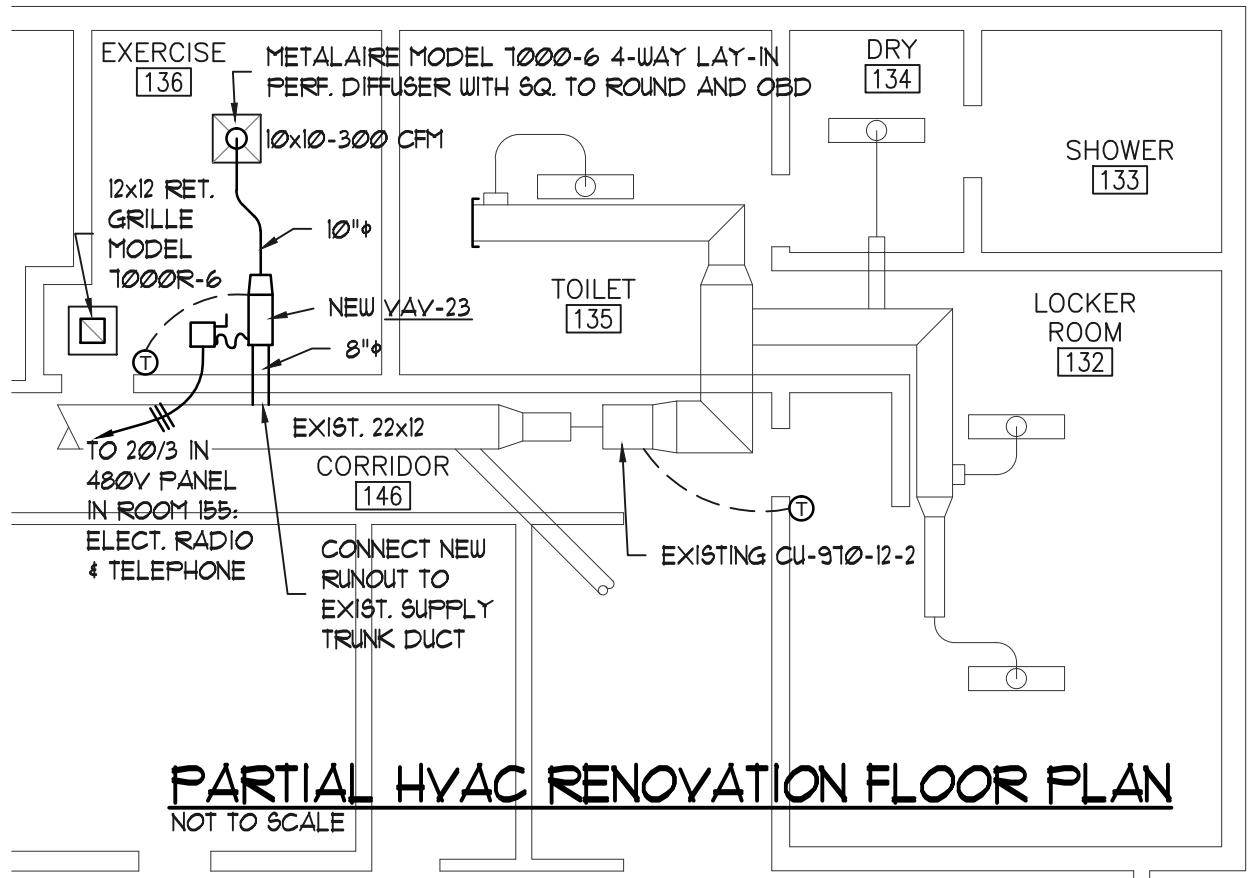
CONDENSING UNIT
INSTALLATION DETAIL
 NOT TO SCALE



ELECTRICAL ROOM 155 PLAN
 NOT TO SCALE



PARTIAL HVAC DEMOLITION FLOOR PLAN
NOT TO SCALE



PARTIAL HVAC RENOVATION FLOOR PLAN
NOT TO SCALE

| Tag | Exist. Tag | Associated Room No. | Carrier Model | Unit Size/ Inlet | Reheat Type | Primary Max Airflow (CFM) | Primary Min Airflow (CFM) | Inlet Pressure (in wg) | Discharge Pressure (in wg) | Heating Capacity (BTU/hr) | Reheat Electric kW | Heating Prim Coil EAT (F) | Heating Coil LAT (F) | Htg Airflow (CFM) | MCA |
|--|-------------|---------------------|---------------|------------------|-------------|---------------------------|---------------------------|------------------------|----------------------------|---------------------------|--------------------|---------------------------|----------------------|-------------------|-------|
| VAV-1 | CU-280-3-2 | 129 | 35E | 5 Inch | Electric | 280.0 | 170.0 | 1.00 | 0.20 | 10.24 | 3 | 55.00 | 92.92 | 250.0 | 4.52 |
| VAV-2 | CU-285-4-2 | 111A | 35E | 5 Inch | Electric | 285.0 | 170.0 | 1.00 | 0.20 | 13.65 | 4 | 55.00 | 99.35 | 285.0 | 6.02 |
| VAV-3 | CU-290-4-2 | 176A | 35E | 5 Inch | Electric | 290.0 | 170.0 | 1.00 | 0.20 | 13.65 | 4 | 55.00 | 98.59 | 290.0 | 6.02 |
| VAV-4 | CU-340-4-2 | 157 | 35E | 6 Inch | Electric | 340.0 | 200.0 | 1.00 | 0.20 | 13.65 | 4 | 55.00 | 97.14 | 300.0 | 6.02 |
| VAV-5 | CU-345-4-2 | 169 | 35E | 6 Inch | Electric | 345.0 | 210.0 | 1.00 | 0.20 | 13.65 | 4 | 55.00 | 97.14 | 300.0 | 6.02 |
| VAV-6 | CU-460-6-2 | 146A | 35E | 6 Inch | Electric | 460.0 | 280.0 | 1.00 | 0.20 | 20.48 | 6 | 55.00 | 97.14 | 450.0 | 9.03 |
| VAV-7 | CU-465-5-2 | 175 | 35E | 6 Inch | Electric | 465.0 | 280.0 | 1.00 | 0.20 | 17.07 | 5 | 55.00 | 100.15 | 350.0 | 7.53 |
| VAV-8 | CU-435-4-2 | 137 | 35E | 6 Inch | Electric | 480.0 | 260.0 | 1.00 | 0.20 | 13.65 | 4 | 55.00 | 97.14 | 300.0 | 6.02 |
| VAV-9 | CU-485-6-2 | 171 | 35E | 6 Inch | Electric | 485.0 | 290.0 | 1.00 | 0.20 | 20.48 | 6 | 55.00 | 99.10 | 430.0 | 9.03 |
| VAV-10 | CU-520-6-2 | 110 | 35E | 7 Inch | Electric | 520.0 | 310.0 | 1.00 | 0.20 | 20.48 | 6 | 55.00 | 99.10 | 430.0 | 9.03 |
| VAV-11 | CU-530-5-2 | 155 | 35E | 7 Inch | Electric | 530.0 | 320.0 | 1.00 | 0.20 | 17.07 | 5 | 55.00 | 96.58 | 380.0 | 7.53 |
| VAV-12 | CU-590-8-2 | 131B | 35E | 7 Inch | Electric | 590.0 | 350.0 | 1.00 | 0.20 | 27.30 | 8 | 55.00 | 100.15 | 560.0 | 12.04 |
| VAV-13 | CU-600-8-2 | 101 | 35E | 7 Inch | Electric | 600.0 | 360.0 | 1.00 | 0.20 | 27.30 | 8 | 55.00 | 100.15 | 560.0 | 12.04 |
| VAV-14 | CU-610-8-2 | 113 | 35E | 7 Inch | Electric | 610.0 | 370.0 | 1.00 | 0.20 | 27.30 | 8 | 55.00 | 100.15 | 560.0 | 12.04 |
| VAV-15 | CU-620-8-2 | 177 | 35E | 7 Inch | Electric | 620.0 | 370.0 | 1.00 | 0.20 | 27.30 | 8 | 55.00 | 100.15 | 560.0 | 12.04 |
| VAV-16 | CU-630-8-2 | 109 | 35E | 7 Inch | Electric | 630.0 | 380.0 | 1.00 | 0.20 | 27.30 | 8 | 55.00 | 100.15 | 560.0 | 12.04 |
| VAV-17 | CU-655-8-2 | 116A | 35E | 7 Inch | Electric | 655.0 | 400.0 | 1.00 | 0.20 | 27.30 | 8 | 55.00 | 100.15 | 560.0 | 12.04 |
| VAV-18 | CU-660-6-2 | 164 | 35E | 7 Inch | Electric | 660.0 | 400.0 | 1.00 | 0.20 | 20.48 | 6 | 55.00 | 99.10 | 430.0 | 9.03 |
| VAV-19 | CU-785-8-2 | 104 | 35E | 8 Inch | Electric | 785.0 | 470.0 | 1.00 | 0.20 | 27.30 | 8 | 55.00 | 100.15 | 560.0 | 12.04 |
| VAV-20 | CU-785-8-2 | 182 | 35E | 8 Inch | Electric | 785.0 | 470.0 | 1.00 | 0.20 | 27.30 | 8 | 55.00 | 100.15 | 560.0 | 12.04 |
| VAV-21 | VAV-4 | 172 | 35E | 9 Inch | Electric | 960.0 | 570.0 | 1.00 | 0.20 | 27.30 | 8 | 55.00 | 99.35 | 570.0 | 12.04 |
| VAV-22 | CU-970-12-2 | 135 | 35E | 9 Inch | Electric | 970.0 | 580.0 | 1.00 | 0.20 | 40.96 | 12 | 55.00 | 99.61 | 850.0 | 18.06 |
| VAV-23 | NEW | 136 | 35E | 6 Inch | Electric | 300.0 | 180.0 | 1.00 | 0.20 | 13.65 | 4 | 55.00 | 97.14 | 300.0 | 6.02 |
| General Notes: | | | | | | | | | | | | | | | |
| All VAV boxes require 460V-3-60 power for electric reheat. | | | | | | | | | | | | | | | |
| All VAV boxes require 2 stages of electric reheat. | | | | | | | | | | | | | | | |
| Maximum VAV box height shall not exceed 14". | | | | | | | | | | | | | | | |
| Refer to original 1974 and 1989 mechanical drawings for existing "CU-XXX-X-X" locations. | | | | | | | | | | | | | | | |
| VAV-23 is a new box, not a replacement for an existing unit. | | | | | | | | | | | | | | | |

GENERAL DECISION: SC20100027 03/12/2010 SC27

Date: March 12, 2010

General Decision Number: SC20100027 03/12/2010

Superseded General Decision Number: SC20080027

State: South Carolina

Construction Type: Building

County: Orangeburg County in South Carolina.

BUILDING CONSTRUCTION PROJECTS (does not include single family homes and apartments up to and including 4 stories)

| | |
|---------------------|------------------|
| Modification Number | Publication Date |
| 0 | 03/12/2010 |

* SUSC1995-003 05/01/1995

| | Rates | Fringes |
|---|----------|---------|
| Carpenter (includes drywall hanging)..... | \$ 10.42 | .46 |
| Cement mason/concrete finisher..... | \$ 10.60 | |
| Electrician..... | \$ 10.44 | .58 |
| Glazier..... | \$ 11.00 | |
| Ironworkers: | | |
| _Reinforcing..... | \$ 10.75 | |
| _Structural..... | \$ 10.00 | |
| Laborer, general..... | \$ 7.25 | |
| Painter, brush..... | \$ 7.96 | |
| Plumber (includes HVAC work)... | \$ 9.60 | |
| Power equipment operators: | | |
| _Backhoe..... | \$ 7.81 | |
| _Grader..... | \$ 7.75 | .94 |
| Sheet metal worker (includes HVAC duct work)..... | \$ 9.59 | |
| Truck driver..... | \$ 7.25 | .94 |

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.
=====

Unlisted classifications needed for work not included within

the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

In the listing above, the "SU" designation means that rates listed under the identifier do not reflect collectively bargained wage and fringe benefit rates. Other designations indicate unions whose rates have been determined to be prevailing.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

- * an existing published wage determination
- * a survey underlying a wage determination
- * a Wage and Hour Division letter setting forth a position on a wage determination matter
- * a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative

Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

=====

END OF GENERAL DECISION

BUY AMERICAN CERTIFICATION

Section 1605 of the American Recovery and Reinvestment Act states that:

“None of the funds appropriated or otherwise made available by this Act may be used for a project for the construction, alteration, maintenance, or repair of a public building or public work unless all of the iron, steel, and manufactured goods used in the project are produced in the United States.”

To meet this requirement, the undersigned hereby certifies that all of the material, equipment and accessories which are to be incorporated into the (Name of Construction Contract) to be partially funded by monies from the American Recovery and Reinvestment Act, has been manufactured from domestic construction material as defined by 40 CFR 35.936-13(D).

Name of Contractor

Date

Signature of Authorized Official

Title

American Recovery and Reinvestment Act Davis-Bacon Compliance

CERTIFICATION

I, _____, on behalf of _____
will comply with the minimum rates for wages for laborers and mechanics
as determined by the Secretary of Labor in accordance with the provisions
of the Davis-Bacon and Related Acts under the General Decision
SC20100027 Wage Determination.

Name of Contractor

Signature of Authorized Official

Printed Name

Date

Vendor Qualifications and Information

Invitation to Bid No. FY10-0920 HVAC Installation and Removal – Law Enforcement Complex

Vendor shall provide with its proposal, the following which should be collated, fastened together, and clearly labeled “Vendor’s Certification of Qualifications and Information for Invitation to Bid No. FY10-0920”:

1. Documentation of vendor’s licenses to demonstrate vendor has sufficient licensing for the scope of work. The minimum licensing for a vendor to qualify for this procurement is as follows:
 - a. A state general contractor’s license as a minimum, a current AC 5 mechanical contractors
2. Documentation of vendor’s specific comparative experience(s) to demonstrate that vendor has successful experience with a comparative scope of work. The vendor’s specific comparative experience should include a brief description of whatever parallels vendor believes exist between the scope of work for this procurement and vendor’s actual experience. Vendor may, but is not required to, supply up to three (3) client references in connection with its response to this item.
3. Documentation of vendor’s general viability to demonstrate vendor can satisfactorily and timely complete the scope of work, including evidence that vendor has all of the following:
 - a. Adequate capital;
 - b. An acceptable credit rating;
 - c. Efficient office force with satisfactory record timely and sufficient materials delivery and communications skills to act as liaison with mechanical trades;
 - d. Efficient and adequate field force with extensive knowledge of each type of work involved in the scope of work;
 - e. An adequate supply of construction equipment in good operating condition; and
4. Vendor’s current organizational chart and a description of the general history of the vendor.
5. A description of any litigation within the last 10 years to which vendor has been a party.

Certification of No Exceptions

Invitation to Bid No. FY10-0920 HVAC Installation/Removal Law Enforcement Complex

The Code requires vendors to give written notice with a submission if vendor will not accept a term of the Invitation to Bid and the incorporated Code as a contract term. See Code §4-302. In connection with that requirement, a vendor must complete this certification and include it in its submission.

Vendor certifies the following regarding its bid:

1. Vendor AGREES to all of the terms of the Invitation to Bid (including the incorporated Code terms) and takes NO EXCEPTIONS: Yes No

2. Vendor does NOT AGREE to all of the terms of the Invitation to Bid (including the incorporated Code terms), and a COMPLETE LIST OF VENDOR'S EXCEPTIONS to same are listed and described below:

Yes No

| Identification Of Excepted Term | Description of vendor's substituted term | Vendor's Initials |
|---------------------------------------|--|----------------------|
|---------------------------------------|--|----------------------|

Exception 1:

Exception 2:

Exception 3:

Exception 4:

The undersigned vendor hereby certifies that the above-listed exceptions comprise the only exceptions vendor has to the Invitation to Bid (including the incorporated Code terms). The undersigned vendor understands and agrees that if it is the successful vendor, its attempt to claim any exceptions other than those listed above, shall result in the County having the right to claim the bid security bond, retract the intent to award or award, award to another vendor, and suspend and/or debar the vendor.

Printed Vendor Name

Signature of Vendor's Authorized Agent

Printed Name of Vendor's Authorized Agent

Title with Vendor of Vendor's Authorized Agent

Certification of Preference(s)

Invitation to Bid No. FY10-0920 HVAC Installation/Removal Law Enforcement Complex

The Code authorizes specific preferences. See Article 3. If a vendor is qualified for one or more preferences and desires to exercise the preference(s), then the vendor must complete and submit this form with its proposal. If a vendor is either (1) not qualified for any preference OR (2) is qualified, but does not desire to exercise any preference, then the vendor does not need to complete or submit this form with its proposal.

Vendor is qualified for and desires to exercise the following preference(s) as vendor has marked, below:

| | | |
|--|------------------------------|-----------------------------|
| Preference 1. Vendor is a resident of the State of South Carolina: | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| Preference 2. Vendor is a resident of Orangeburg County, SC: | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| Preference 3. Vendor is an MBE: | <input type="checkbox"/> Yes | <input type="checkbox"/> No |

The undersigned vendor hereby certifies that vendor is qualified for the preference(s) above to which the vendor has indicated "Yes". In addition, the undersigned vendor understands and agrees that if it is not qualified for a preference, but claims to be qualified for a preference on this form, the County shall have the right to suspend and/or debar the vendor in accordance with the Code.

Printed Vendor Name

Signature of Vendor's Authorized Agent

Printed Name of Vendor's Authorized Agent

Title with Vendor of Vendor's Authorized Agent

Certified Bid

Invitation to Bid No. FY10-0920 HVAC Removal/Installation Law Enforcement Complex

Equipment/Supplies/All other Materials Bid Amount (\$_____)

Labor Amount (Not taxable) (\$_____)

Total Bid Amount (\$_____)

Printed Vendor Name: _____

Preliminary Equipment Listing (Buy American Agreement on equipment maybe enforced)

30 ton air handler

15 ton air handlers

30 ton condensing unit

(2)15 ton condensing units

2 ton ductless split system

(5) electric duct heaters

(23) VAV boxes with electric heat

By signature below, the submitting vendor certifies to Orangeburg County that:

1. The Total Bid Amount, above, is inclusive of all costs, including labor, supervision, materials, supplies, transportation, permits, licenses, taxes or any other costs, incidental or otherwise, for complete and proper performance of the scope of work described in Invitation to Bid FY10-0920
2. Vendor understands and agrees that, due to budget constraints, Orangeburg County reserves the right to adjust or amend the work requirements and/or negotiate with the lowest, most responsive, qualified, and responsible bidder in an effort to reach a cost that is fair, reasonable, and acceptable to both parties.
3. The foregoing bid: contains bid prices that are firm for a minimum of 90 days from the date of opening; is made without prior understanding, agreement, or connection with any other submitting vendor; and is in all respects fair and without collusion or fraud.

Printed Vendor Name

Signature of Vendor's Authorized Agent

Date of Signature

Printed Name of Vendor's Authorized Agent

Title with Vendor of Vendor's Authorized Agent

Addendum Acknowledgement

Request for Qualifications FY10-0920 HVAC Installation/Removal Law Enforcement Complex

Vendor acknowledges receipt of the follow Addendum to the above-described procurement, agrees that same is/are hereby incorporated and made a part of the above-described procurement as if the Addendum had been included in the original procurement documents:

| <u>Addendum No.</u> | <u>Addendum Date</u> | <u>Initials of Vendor's Authorized Agent</u> |
|---------------------|----------------------|--|
| _____ | _____ | _____ |
| _____ | _____ | _____ |
| _____ | _____ | _____ |

Printed Vendor Name

Signature of Vendor's Authorized Agent

Printed Name of Vendor's Authorized Agent

Title with Vendor of Vendor's Authorized Agent