

SECTION 238119 – SELF CONTAINED AIR CONDITIONING UNITS

Latest Update 05-05-2023. See Underlined Text for Edits

(Engineer shall edit specifications and blue text in header to meet project requirements. This includes but is not limited to updating Equipment and/or Material Model Numbers indicated in the specifications and adding any additional specifications that may be required by the project. Also turn off all “Underlines”.)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section and all other sections of Division 23.

1.2 SUMMARY <Edit required for project>

- A. This section includes the requirements for self-contained water cooled air conditioning units intended for indoor installations and related equipment as follows:
 - 1. Ceiling mounted unit.
 - 2. Above ceiling mounted ducted unit
 - 3. Vertical floor mounted unit
 - 4. Vertical floor mounted ducted unit
 - 5. Remote dry cooler
 - 6. Glycol pump package
- B. Water cooled units may be utilized for the following applications were indicated on the drawings: <Edit required for project>
 - 1. Computer rooms
 - 2. Server rooms
 - 3. Supplemental cooling units – above ceiling ducted units only.

1.3 ACTION SUBMITTALS

- A. Product Data: For each specified product, include manufacturers cut sheets, dimensional data, performance data, refrigerant type, micro-processor controller, installation instructions, wirings diagrams, power requirements, specified options, and warranty information.
- B. LEED Submittals: <delete if not LEED>
 - 1. Product Data for Credit EA 4: Documentation indicating that equipment and refrigerants comply.

2. Product Data for Prerequisite IEQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 2. Wiring Diagrams: For power, signal, and control wiring.
- D. Samples for Initial Selection: For units with factory-applied color finishes.
- 1.4 INFORMATIONAL SUBMITTALS
- A. Warranty: Sample of special warranty.
- B. Field quality-control reports.
- 1.5 CLOSEOUT SUBMITTALS
- A. Operation and Maintenance Data: Include a copy of each approved submittal along with any applicable maintenance data in the project operation and maintenance manual.
- B. Maintenance Material Submittals:
1. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
<Edit required for project>
 - a. Filters: One (1) set(s) of filters for each unit.
 - b. Fan Belts: One (1) set(s) of belts for each unit.
- 1.6 QUALITY ASSURANCE
- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ARI Compliance:
1. Applicable requirements in ARI 210/240.
 2. Applicable requirements in ARI 340/360.
 3. Applicable requirements in ARI 390.

C. ASHRAE Compliance:

1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - "Ventilation Rate Procedures," and Section 7 - "Construction and Startup."

D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

1.7 COORDINATION

- A. Coordinate layout and installation of water cooled units and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire suppression system, and partition assemblies.
- B. Coordinate installation of water cooled air conditioning units with computer room access flooring installer.
- C. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.8 WARRANTY/GUARANTEE

- A. See Division 23 Specification Section "Basic Mechanical Requirements – HVAC" for warranty and guarantee requirements.

PART 2 - PRODUCTS

2.1 GENERAL PRODUCT REQUIREMENTS

- A. Equipment Design and Selection: Self contained water cooled DX units shall be designed and selected in accordance with the scheduled capacities on the drawings and the requirements of this specification.
- B. Basis of Design: The basis of design is self-contained air conditioning equipment manufactured by Above Air Technologies as follows:
 1. Above Ceiling Non Ducted Units: Model AWC
 2. Above Ceiling Ducted Units: Model AWC
 3. Vertical Non Ducted Units: Model MCW
 4. Vertical Ducted Units: Model MCW
- C. Other Acceptable Manufacturers: Subject to compliance with requirements, provide self-contained air conditioning equipment by Stultz Air Technologies:

1. Above Ceiling Non Ducted Units: Ceilar Model OHS
2. Above Ceiling Ducted Units: Ceilar Model OHS
3. Vertical Non Ducted Units: Cyber One Model COS
4. Vertical Ducted Units: Cyber One Model COS

D. BAS Interface: Units shall be furnished with software communications interface capability for connectivity to the external Building Automation System through Bac Net IP Protocol connection for monitoring and control and comply with the points list in this specification.

2.2 CEILING MOUNTED WATER COOLED DX UNITS <Edit required for project>

A. Unit Configuration: Unit configuration shall be as follows: <Edit for Project Requirements>

1. Ductless Configuration: Unit shall be designed for installation in a standard two (2) foot by four (4) foot ceiling grid with bottom supply grille and return filter grille. <Delete if not Required>
2. Ducted Configuration: Unit shall be provided with one (1) inch flanged duct connections for supply and return ductwork. <Delete if not Required>

B. Unit Casing and Condensate Drain Pan: Unit casings shall be constructed with 0.062 inch aluminum panels and supported by internal three sixteenths (3/16) inch aluminum frames, or galvanized construction with minimum 18 gauge unit frames, 18 gauge minimum unit corner posts, and minimum 20 gauge unit panels. Casing shall be lined with Armacell one half (1/2) inch thick, closed cell fiber free elastomeric foam insulation with an 'R' value of 2.1 at indicated thickness and conforming to ASTM C534, ASTM E84, NFPA 225, UL 723 and NFPA 90A, 90B. The internal condensate drain pan shall be constructed of 18 gauge stainless steel with drain connection on the same end as the pipe connections for the water cooled condenser. Provide removable access panels for access to fans, filters, coils, compressors and refrigeration components.

C. Fan Types: Fan type shall be as follows: <Edit for Project Requirements>

1. Non-Ducted Units (1-3 Tons): Supply fan/motor shall be a standard ECM direct drive assembly with a double inlet, dynamically balanced fan with backward inclined blades, and motor. Fan and motor shall be mounted on vibration isolators. Fan and motor assemblies that are rigid mounted to the cabinet are acceptable provided the unit is provided with external isolation. Fans with forward curved blades and motor are acceptable. <Delete if not Required>
2. Ducted Units – High Static (1-10 Tons): Supply fan/motor shall be an ECM direct drive high efficient assembly with double inlet, dynamically balanced fan with backward inclined blades, and motor. Fan and motor shall be mounted on vibration isolators. Fan and motor assemblies that are rigid mounted to the cabinet are acceptable provided the unit is provided with external isolation. See unit

schedule on drawings for external static pressure requirements. Fans with forward curved blades and motor are acceptable. <Delete if not Required> <Engineer Note: “High Static” means an ESP @ 0.30” and above + Unit PD>

- D. Filters: Filters shall be manufacturers standard one (1) inch, 20% efficient filter.
- E. Evaporator System: Evaporator system shall be configured for a draw through air pattern to provide uniform air distribution over the evaporator coil face. Coils shall be constructed of seamless drawn copper tubes, mechanically bonded to tempered aluminum fins with a raised lanced fin design for maximum heat transfer. Coil end plates shall be hot dipped galvanized steel. The evaporator coil shall be mounted in a stainless steel condensate drain pan.
- F. Refrigeration System: The refrigeration system shall include a scroll high efficiency, high reliability, low noise compressor(s), with hot gas bypass, mounted on vibration isolators, type ‘L’ copper refrigeration tubing with brazed fittings, sight glass, externally equalized expansion valve, and liquid line filter dryer. The refrigeration system shall be pre charged with HCFC – 407-C or 410-A refrigerant. The water cooled condenser shall be a tube in tube counter flow condenser rated for 150 psi. < Engineer Note: For units with a capacity of one (1) to five (5) tons provide a single scroll compressor. For units with a capacity of six (6) to ten (10) tons provide dual scroll compressors.>
- G. Adjustable Water Regulating Valve: Adjustable water regulating valve by manufacturer to maintain head pressure with process cooling water conditions of 70°F EWT/ 90°F LWT. Include GPM and unit pressure drop in feet in the submittal data
- H. Control Panel: Unit mounted pre-wired control panel shall include contactors, relays, control transformer, capacitors, high and low refrigerant pressure switches, compressor and fan automatic reset safety devices for a complete control system.
- I. Unit Power Supply: Single Source power supply shall be as follows: <Edit for Project Requirements>
1. One (1) and One and One Half (1-1/2) Ton Units: 208/277 volt single phase. <Delete if not Required>
 2. Two (2) and Three (3) Ton Units: 208/277 volt single phase. 208/460 volt three phase. <Delete if not Required>
 3. Four (4) Tons and Larger: 208/460 volt three phase. <Delete if not Required>
- J. Microprocessor Control: Provide manufacturer’s microprocessor, for each water cooled A/C unit, with a BAC NET IP serial card. Provide manufacturer’s microprocessor, for each water cooled A/C unit, with a BAC NET IP serial card. Microprocessor shall be Model MC 2000 by Above Air Technology or Model ES by Stultz Air Technology. Inputs and outputs shall be remotely monitored (address readable) through the BAS. At a

minimum, the following I/O addressable points shall be included: <Edit for Project Requirements>

1. Unit on/off
2. Compressor running Module1
3. Fan running Module1
4. Compressor low pressure alarm Module1
5. Compressor high pressure alarm Module1
6. Air flow alarm Module1
7. Water detector alarm Module1 (condensate pan)
8. Room temperature to high alarm
9. Room temperature to low alarm
10. Supply temperature to high alarm
11. Supply temperature to low alarm
12. Water temperature to high alarm (Process Cooling Water)
13. Water temperature to low alarm (Process Cooling Water)
14. Set point temperature
15. Set point supply air temperature
16. Actual return air temperature
17. Supply air temperature

K. Humidity Control: For systems requiring Humidity Control include the following points:
<Delete if not Required>

1. Humidity Sensor
2. Humidifier Active
3. Humidifier Failure Alarm
4. Room Humidity to High
5. Room Humidity to Low

L. Accessories: Accessories shall include the following:

1. Overflow Safety Switch: A condensate pan water level switch shall be incorporated to shut the system down if an overflow condition is sensed.
2. Supply Air Temperature Sensor/Monitor: Provide a supply air temperature sensor for field installation in the supply air grille and wired through the microprocessor controller to the BAS. Sensor shall only monitor the supply air temperature with a signal to BAS.
3. Condensate Pump: A Low-Profile condensate pump shall be provided for automatic removal of condensate and humidifier flush water (if applicable). In addition to the standard condensate pan overflow safety float(s), the condensate pump shall include an internal overflow safety float switch. When wired to the A/C's remote stop/start terminals, the switch shall open the A/C's control circuit, thereby shutting the A/C down in the event of a condensate overflow. The

condensate pump shall be specifically designed to operate with the higher condensate temperatures caused by the flush and drain cycle of the electrode canister humidifiers. <Delete if not Required>

4. Remote Water/Leak Dector (Ducted Units Only): Where auxiliary drain pans are indicated provide a Spot type leak detector for remote field installation. Also include a 24 volt water detector power module for require field mounting and wiring to the factory provided terminal connection, providing a remote notification of water detection alarm. Upon sensing a water leak, the normally closed water detector control circuit shall open, thereby shutting down the unit's water producing components. <Delete if not Required>
5. Disconnect Switch: Provide manufacturer's unit mounted non-fused disconnect switch.

2.3 FLOOR MOUNTED VERTICAL DX WATER COOLED UNITS

- A. Unit Configuration: Unit configuration shall be as follows: <Edit for Project Requirements>
 1. Ductless Configuration (1-10 Tons): Unit shall be provided with a discharge plenum located on top of the unit with three (3) supply grilles. Return air grille shall be located on the front panel of the unit <Delete if not Required>
 2. Ducted Configuration (1-10 Tons): Unit shall be provided with evaporator supply air flanged duct connection located on top of the unit. Return air grille shall be located on the front panel of the unit <Delete if not Required>
- B. Unit Casing and Condensate Drain Pan: Unit casings shall be constructed from 16 gauge galvanized steel panels and supported by internal three sixteenths (3/16) inch galvanized steel frames. Casing shall be lined with Armacell one half (1/2) inch thick, closed cell fiber free elastomeric foam insulation with an 'R' value of 2.1 at indicated thickness and conforming to ASTM C534, ASTM E84, NFPA 225, UL 723 and NFPA 90A, 90B. The internal condensate drain pan shall be constructed of 20 gauge stainless steel with drain connection on the same end as the pipe connections for the water cooled condenser. Unit Color shall be the manufacturer's standard color.
- C. Fan Types: Fan type shall be as follows: <Edit for Project Requirements>
 1. Non-Ducted Units (1-10 Tons): Supply fan/motor shall be a standard ECM direct drive assembly with a double inlet, dynamically balanced fan with backward inclined blades, and motor. Fan and motor shall be mounted on vibration isolators. Fan and motor assemblies that are rigid mounted to the cabinet are acceptable provided the unit is provided with external isolation. Fans with forward curved blades and motor are acceptable. <Delete if not Required>
 2. Ducted Units – High Static (1-10 Tons): Ducted Units – High Static (1-10 Tons): Supply fan/motor shall be an ECM direct drive high efficient assembly with dou-

ble inlet, dynamically balanced fan with backward inclined blades, and motor. Fan and motor shall be mounted on vibration isolators. Fan and motor assemblies that are rigid mounted to the cabinet are acceptable provided the unit is provided with external isolation. See unit schedule on drawings for external static pressure requirements. Fans with forward curved blades and motor are acceptable. <De-
<Engineer Note: “High Static” means an ESP @ 0.30” and
above + Unit PD>

- D. Evaporator Coil: Evaporator coil shall be design to provide maximum coil surface area and minimum depth to provide a high sensible cooling capacity. Coils shall be constructed of seamless drawn copper tubes, mechanically bonded to tempered aluminum fins with a raised lanced fin design for maximum heat transfer. Coil end plates shall be hot dipped galvanized steel. The evaporator coil shall be mounted in a stainless steel condensate drain pan. Coils in a ‘A’ frame configuration or slab configuration are acceptable.
- E. Filter Chamber and Filter: Filters chamber shall be an integral part of the unit, located within the cabinet. Filter shall be slide out type, (2) inch deep class 2 filter per U.L. Standard 900 and shall also have a rating of at least 80% average arrestance as measured by ASHRAE Standard 52-76 test method. Filter shall be accessible through front hinged access door.
- F. Refrigeration System: The refrigeration system shall include a single scroll high efficiency, high reliability, low noise compressors, with hot gas bypass, mounted on vibration isolators, type ‘L’ copper refrigeration tubing with brazed fittings, sight glass, externally equalized expansion valve, liquid line filter dryer, and charging and service ports. The refrigeration system shall be pre charged with HCFC – 407-C or 410–A refrigerant. The water cooled condenser shall be a tube in tube counter flow condenser rated for 150 psi.

<Engineer Note: For unit sizes 6 tons and above dual scroll compressors are available. Coordinate with UMB for number of compressors and edit paragraph ‘G’ accordingly.>

- G. Electric Reheat: Include a factory mounted and wired single stage electric reheat with 24 volt control circuit to provide an automatic reheating mode during the dehumidification cycle and automatic heating mode as required. Electric heaters shall be provided with thermal/magnetic circuit breakers which shall protect each conductor. Heaters shall use fast reacting nichrome wire heater elements, which cool quickly when turned off, eliminating residual heat issues. The heater elements shall be housed in within a stainless steel frame with mounted supports. Also include one (1) automatic resetting over temperature safety device (pilot duty) and a non- resettable over temperature safety device located in the main power line.

- H. Humidifier: The humidifier shall be an electrode steam canister type and shall have an adjustable humidity output setting from 25% to 100% of the full rated humidifier capacity. The humidifier shall have an automatic flush cycle that senses the current consumption of the humidifier and controls mineral concentration of the water. A “Change Cylinder” light shall notify service personnel when the humidification output is below rated requirements and when maintenance is due.
- I. Adjustable Water Regulating Valve: Adjustable water regulating valve by manufacturer to maintain head pressure with process cooling water conditions of 68°F EWT/ 90°F LWT. Include GPM and unit pressure drop in feet in the submittal data.
- J. Control Panel: Unit mounted pre-wired control panel shall include contactors, relays, control transformer, capacitors, high and low refrigerant pressure switches, compressor and fan automatic reset safety devices for a complete control system.
- K. Modular Motor Controllers: The systems shall incorporate modular motor controllers utilizing motor start protectors and circuit breakers to eliminate the need for fuses. The control circuit shall be a 24 VAC Class II low voltage circuit, including primary and secondary circuit protection. Low voltage, high voltage, and common wires shall be color-coded and shall be individually numbered at each end for ease of service tracing. All wiring shall be in accordance with the National Electric Code (NEC) and shall include:
1. Motor branch circuit short circuit protection;
 2. Motor load switching controllers (contactors)
 3. Motor overload protection.
- L. Unit Power Supply: Single Source power supply shall include a unit mounted main power dust proof, non fused type disconnect switch with a lockable handle for the following: <Edit for Project Requirements>
1. One (1) and One and One Half (1-1/2) Ton Units: 208/277 volt single phase. <Delete if not Required>
 2. Two (2) and Three (3) Ton Units: 208/277 volt single phase. 208/460 volt three phase. <Delete if not Required>
 3. Four (4) Tons and Larger: 208/460 volt three phase. <Delete if not Required>
- M. Microprocessor Control: Provide manufacturer’s microprocessor, for each water cooled A/C unit, with a BAC NET IP serial card. Microprocessor shall be Model MC 2000 by Above Air Technology or Model ES by Stultz Air Technology. Inputs and outputs shall be remotely monitored (address readable) through the BAS. At a minimum, the following I/O addressable points shall be included: <Edit for Project Requirements>
1. Unit on/off

2. Compressor running Module1
3. Fan running Module1
4. Compressor low pressure alarm Module1
5. Compressor high pressure alarm Module1
6. Air flow alarm Module1
7. Water detector alarm Module1 (condensate pan)
8. Room temperature to high alarm
9. Room temperature to low alarm
10. Supply temperature to high alarm
11. Supply temperature to low alarm
12. Water temperature to high alarm (Process Cooling Water)
13. Water temperature to low alarm (Process Cooling Water)
14. Set point temperature
15. Set point supply air temperature
16. Actual return air temperature
17. Supply air temperature

N. Humidity Control: For systems requiring Humidity Control include the following points:
<Delete if not Required>

1. Humidity Sensor
2. Humidifier Active
3. Humidifier Failure Alarm
4. Room Humidity to High
5. Room Humidity to Low

O. Accessories: Accessories shall include the following:

1. Overflow Safety Switch: A condensate pan water level switch shall be incorporated to shut the system down if an overflow condition is sensed. <Delete if not Required>
2. Supply Air Temperature Sensor/Monitor: Provide a supply air temperature sensor for field installation in the unit and wired through the microprocessor controller to the BAS. Sensor shall only monitor the supply air temperature with a signal to BAS.
3. Capacity Assist Option: Where multiple units will condition the same room provide the capacity assist option. Program the vertical unit as the active unit and the ceiling unit as the assist unit. On a call for cooling the active unit, shall be energized, through its controller, to maintain the room set point (75). If the active unit cannot satisfy the room set point, the assist unit shall be energized through its unit controller to assist the active unit. When the room set point is satisfied the assist unit shall be de-energized, then the active unit shall be de-energized. Program the active unit for cooling, dehumidification, reheating and humidification.

Program the assist unit for the same functions and include a 3°F, 3% RH differential between the active and assist units. <Delete if not Required>

2.4 REMOTE DRYCOOLER: < Edit for Project or Delete if not Required >

- A. Remote Outdoor Propeller Fan Drycooler: Drycooler casings shall be fabricated from heavy aluminum for corrosion protection and appearance. Structural components shall be fabricated from galvanized steel for support. Motors shall be permanently lubricated ball bearings and be internally protected. Fans shall be propeller type with blades made from aluminum and shall have zinc plated hubs for strength and corrosion protection. Drycooler shall have internal air baffles to prevent air bypass from one fan section to another and to maximize air through each coil section. The drycooler shall be designed to have the scheduled capacities at 105°F ambient air temperature. Manufacturer of drycooler shall be Stulz, model series “FSS” or approved equal by Liebert, provided that the system can be monitored and controlled via the existing Siemens Building Automation System (BAS). Drycooler shall have support legs integral to the chassis/frame. Drycooler coils shall be copper, complying with ASTM B 75. Fins shall be aluminum. Fin and tube joint shall be mechanical bond. Headers shall be seamless copper tube with brazed joints, prime coated. Capacity shall be based on using Dowtherm SWR-1, 40% solution.
- B. Drycooler/Fan Cycling Control Box: The drycooler control box shall be factory mounted in an outdoor rated enclosure. Each Drycooler/Fan Cycling Control Box shall electrically interface to the GPS pump package via a 24-volt low voltage connection. The drycooler control box shall include, but not be limited to:
 1. Fan Motor starter(s)/contactor(s)
 2. Fan Cycling Aquastat(s) to sense coolant temperature to maintain proper coolant temperature in DX mode, and Free Cooling Mode (if applicable).
 3. Main Power Non-Fused Disconnect Switch.
- C. Terminal strip for external connectivity to A/C Unit or Building Automation System. The terminal strip shall have dry contact available which will allow for the following:
 1. Enable/disable drycooler
 2. Flow status

2.5 GLYCOL PUMP PACKAGE: <Delete if not required >

- A. Dual Pump Package: The Pump Package shall be provided with two redundant, equal horsepower pumps, with one operating continuously (primary) and the second pump to provide redundancy (backup) in the event of a failure of primary pump. A coolant sensing flow switch shall be provided for automatic switch-over of primary to backup pump operation in the event of coolant flow loss. The controls shall be mounted in a

NEMA-3R enclosure at the end of the pump package. Each pump shall be mounted on a steel angle chassis and be protected by a removable aluminum cover. Manufacturer of glycol pump package shall be Stulz, model series “GPS” or approved equal by Liebert, provided that the system can be monitored and controlled via the existing Siemens Building Automation System (BAS). Each pump package shall include, but not be limited to:

1. Pump starter(s)/contactor(s) with fusing per NEC;
2. A fifteen (15) gallon expansion tank;
3. An airtrol fitting (automatic air bleed valve)

B. Dry Cooler and Pump Package – BAS Interface: <Delete if not Required>

1. Provide BAC Net IP Serial Cards and/or communication software with the following points to interface with the BAS:
 - a) Drycooler Enable/Disable—Digital Output
 - b) Drycooler Status (via flow switch)—Digital Input
 - c) Supply Water Temperature — Analog Output
 - d) Return Water Temperature — Analog Output
 - e) Pump Status —Digital Input
2. See Division 23 BAS Specification Sections for additional information.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with the installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the work.
- B. Examine roughing-in for hydronic piping systems to verify actual locations of piping connections before equipment installation.
- C. Examine project area for suitable conditions where water cooled air conditioning units will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION <Edit for project>

- A. Anchor units to structure.

- B. Install water cooled units air conditioners level and plumb, maintaining manufacturer's recommended clearances. Install according to ARI Guideline B.
- C. Vertical Water Cooled Units Computer Rooms: Comply with requirements for vibration isolation devices specified in Division 23 Specification Section "Vibration and Seismic Controls for HVAC Systems."
 - 1. Minimum Deflection: One quarter (1/4) inch.
- D. Suspended Water Cooled Units: Install using continuous-thread hanger rods and spring hangers of size required to support weight of computer-room air conditioner.
 - 1. Comply with requirements for hangers and supports specified in Division 23 Specification Section "Hangers and Supports for HVAC Piping Systems."
- E. Remote, Air Cooled, Glycol- Cooler Mounting: Comply with requirements for vibration isolation devices specified in Division 23 Specification Section "Vibration and Seismic Controls for HVAC Systems." <Delete if not Required>
 - 1. Minimum Deflection: One quarter (1/4) inch.
- F. Glycol Solution Pump Package Mounting: Comply with requirements for vibration isolation devices specified in Division 23 Specification Section "Vibration and Seismic Controls for HVAC Systems." <Delete if not Required>

3.3 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties. Arrange piping to remain clear of manufacturers recommended space for maintenance and service.
- B. Domestic Water Connections: Comply with applicable requirements in Division 22 Specification Section "Domestic and Laboratory Water Piping Systems and Specialties." Provide connections for humidifier.
- C. Condensate Drainage Connection: Comply with applicable requirements in Division 22 Specification Section "Storm Water Piping System and Specialties." Provide connections for condensate drain.
- D. Hot Water Heating Piping: Comply with applicable requirements in Division 23 Specification Section "HVAC Piping Systems and Specialties." Provide shutoff valves in inlet and outlet piping to heating coils. <Delete if not Required>
- E. Process Cooling Water Piping: Comply with applicable requirements in Division 23 Specification Section "HVAC Piping Systems and Specialties." Provide shutoff valves in inlet and outlet piping to the compressor.

- F. Duct Connections: For ducted units provide flexible connections for supply and return duct connections to the units. <Delete if not Required>

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
 - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation, and inspect for refrigerant leaks.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Provide a seven (7) days notice to UMB for owner to witness the inspection and testing.
- D. Units will be considered defective if they do not pass tests and inspections.
- E. Prepare and submit test and inspection reports to the CM.

3.5 STARTUP SERVICE

- A. Engage a factory authorized service representative to perform startup service.
- B. Provide a seven (7) days notice to UMB for owner to witness the start up service.

3.6 COMMISSIONING

- A. See Division 23 Specification Section “Commissioning Mechanical Systems” for requirements.

3.7 DEMONSTRATION

- A. Engage a factory authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.
- B. Provide a seven (7) days notice to UMB for owner to attend the demonstration.

END OF SECTION 238119