

SECTION 236423 – Portable AIR COOLED SCROLL WATER CHILLERS

PART 1 - Air Cooled Chiller

PART 2 - GENERAL

2.1 SUMMARY

- A. Section Includes: Packaged, air-cooled, electric-motor-driven, scroll water chillers.
- B. Chiller must be mounted and secured on a trailer and completely wired and assembled with all piping, wiring, and accessories listed in this document. All piping and installation must meet local code. All hoses and fitting to be provided inside the trailer compartments.

2.2 PERFORMANCE REQUIREMENTS

- a. Seismic Performance: Scroll water chillers shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
- b. Chiller shall meet IBC seismic and OSHPD pre-approval with SDS (design spectral response acceleration at short period) equal to at least 2.0g.
- c. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event.

A. REFERENCES

- A. Comply with applicable Standards/Codes of AHRI 550/590, ANSI/ASHRAE 15, ETL, cETL, NEC, and OSHA as adopted by the State.
- B. Units shall meet the efficiency standards of the current version of ASHRAE Standard 90.1, and FEMP standard 2012.

2.3 SUBMITTALS

- A. Product Data: Include refrigerant, rated capacities, operating characteristics, furnished specialties, and accessories.
- B. Certificates: For certification required in "Quality Assurance" Article.
- C. Seismic Qualification Certificates: For water chillers, accessories, and components from manufacturers.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
 4. Provide a copy of chiller
- D. Startup service reports.
- E. Operation and maintenance data.
- F. Warranty.

2.4 QUALITY ASSURANCE

- A. ARI Rating: Rate water chiller performance according to requirements in ARI 550/590, "Water Chilling Packages Using the Vapor Compression Cycle."
- B. ASHRAE Compliance: ASHRAE 15 for safety code for mechanical refrigeration.
- C. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6 - "Heating, Ventilating, and Air-Conditioning."
- D. ASME Compliance: Fabricate and stamp water chiller heat exchangers to comply with ASME Boiler and Pressure Vessel Code.
- E. Comply with NFPA 70.
- F. Equipment manufacturer must specialize in the manufacture of the products specified and have five years of experience with the type of equipment and refrigerant offered.
- G. Regulatory Requirements: Comply with the codes and standards specified.
- H. Chiller manufacturer plant must be ISO Registered.

2.5 WARRANTY

- C. Standard Warranty: The refrigeration equipment manufacturer's guarantee shall be for a period of one year from date of equipment start-up but not more than 18 months from shipment. The guarantee shall provide for repair or replacement due to failure by material and workmanship that prove defective within the above period, excluding refrigerant.
- D. Complete Five Years parts, Labor, refrigerant Warranty: Entire unit.
- E. Five years complete full factory service maintenance contract per manufacturer IOM.
- F. Provide quarterly inspection report including oil and refrigerant analysis.
- G. Wash and clean the condenser coils once a year before cooling season starts.
- H. Include 5 years manufacturer full service maintenance for the chiller.

PART 3 - PRODUCTS

3.1 PACKAGED AIR-COOLED WATER CHILLERS

- A. Chiller shall be completely assembled and mounted on a trailer including the dual pump skid, transformer, dual VFDs,
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers.
- C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - 1. Carrier
 - 2. Daikin
 - 3. Trane

3.2 Chiller Capacity: 240 tons, 460/3/60, 44/55., 95 F Ambient, Min IPLV: 17.2, Min EER: 10.25

- A. Description: Factory-assembled and run-tested water chiller complete with base and frame, condenser casing, compressors, compressor motors and motor controllers, evaporator, condenser coils, condenser fans and motors, electrical power, controls, and accessories. Provide and install as shown on the plans factory-assembled, factory-charged air-cooled scroll compressor packaged chillers in the quantity specified. Each chiller shall consist of hermetic trio scroll compressor sets (total six compressors), Tub and Shell or brazed plate evaporator, air-cooled condenser section, microprocessor-based control system and all components necessary for controlled unit operation.
- B. Each chiller shall be factory run-tested to verify operation. Operating controls and refrigerant charge shall be checked for proper operation and optimum performance.
- C. Fabricate base, frame, and attachment to water chiller components strong enough to resist movement during a seismic event when water chiller base is anchored to field support structure.
- D. Cabinet:
 - 1. Base: Painted Galvanized-steel base extending the perimeter of water chiller. Secure frame, compressors, and evaporator to base to provide a single-piece unit.
 - 2. Frame: Painted rigid galvanized-steel frame secured to base and designed to support cabinet, condenser, control panel, and other chiller components not directly supported from base.
 - 3. Casing: Pre-painted Galvanized steel.
 - 4. Finish: Coat base, frame, and casing with a corrosion-resistant coating capable of withstanding a 1000-hour salt-spray test according to ASTM B 117.
 - 5. Sound-reduction package consisting of the following:
 - a. Acoustic enclosure around compressors.
 - b. Reduced-speed fans with acoustic treatment.
 - c. Designed to reduce sound level without affecting performance.

6. Security Package: Provide metal security louvers with fasteners for additional protection of compressors, evaporator, and condenser coils. Metal louvers shall be coated for corrosion resistance and shall be removable for service access.

E. Compressors:

- I. Description: Positive-displacement direct drive scroll with hermetically sealed casing. Compressor. The compressors shall be sealed hermetic, scroll type with crankcase oil heater and suction strainer. The compressor motor shall be refrigerant gas cooled, high torque, hermetic induction type, two-pole, with inherent thermal protection on all three phases and shall be mounted on RIS vibration isolator pads. The compressors shall be equipped with an internal module providing compressor protection and communication capability.
- J. Chiller shall not have more than six compressors.
 1. Each compressor provided with suction and discharge service valves, crankcase oil heater, and suction strainer.
 2. Operating Speed: Nominal 3600 rpm for 60-Hz applications.
 3. Capacity Control: On-off compressor cycling plus hot-gas bypass on both circuits and separate isolation valve.
 4. Oil Lubrication System: Automatic pump with strainer, sight glass, filling connection, filter with magnetic plug, and initial oil charge.
 5. Filter drier shall be shell and replaceable core type.
 6. Vibration Isolation: Mount individual compressors on vibration isolators.

F. Compressor Motors:

1. Hermetically sealed and cooled by refrigerant suction gas.
2. High-torque, two-pole induction type with inherent thermal-overload protection on each phase.

G. Compressor Motor Controllers:

1. Across the Line: NEMA ICS 2, Class A, full voltage, non-reversing.

H. Refrigeration:

1. Refrigerant: R-410a only.
2. Chiller shall have two independent refrigeration circuits. Single circuit is not acceptable. Each of the two refrigerant circuits shall include a refrigerant filter-drier, sight glass with moisture indicator, liquid line solenoid valve (no exceptions), expansion valve, and insulated suction line.
3. Refrigerant Compatibility: Parts exposed to refrigerants shall be fully compatible with refrigerants, and pressure components shall be rated for refrigerant pressures.
4. Refrigerant Circuit: Each circuit shall include a thermal-expansion valve, refrigerant charging connections, a hot-gas muffler, compressor suction and discharge shutoff valves, a liquid-line shutoff valve, a replaceable-core filter-dryer, a sight glass with moisture indicator, a liquid-line solenoid valve, and an insulated suction line.
5. Refrigerant Isolation: Factory installed positive shutoff isolation valves in the compressor suction, discharge line, and the refrigerant liquid-line to allow the isolation and storage of the refrigerant charge in the chiller condenser.

I. Evaporator:

1. Shell and Tube:

- a. Description: Direct-expansion, shell-and-tube design with fluid flowing through the shell and refrigerant flowing through the tubes within the shell.
 - b. Code Compliance: Tested and stamped according to ASME Boiler and Pressure Vessel Code.
 - c. Shell Material: Carbon steel.
 - d. Shell Heads: Removable carbon-steel heads with multi-pass baffles designed to ensure positive oil return and located at each end of the tube bundle.
 - e. Shell Nozzles: Fluid nozzles located along the side of the shell and terminated with mechanical-coupling end connections for connection to field piping.
 - f. Tube Construction: Individually replaceable copper tubes with enhanced fin design, expanded into tube sheets.
 - g. The water-side working pressure shall be a minimum of 653 psig (4502 kPa). Vent and drain connections shall be provided in the inlet and outlet chilled water piping by the installing contractor. Evaporators shall be designed and constructed according to, and listed by, Underwriters Laboratories (UL).
 - h. The evaporator shall be protected with an electric resistance heater (heat trace tape) and insulated with 3/4" (19mm) thick closed-cell polyurethane insulation. This combination shall provide freeze protection down to -20°F (-29°C) ambient **Chiller shall have factory mounted Y-Strainer for Evaporator.**
 - i. **Chiller shall have factory mounted Thermal Dispersion Flow Switch (Paddle Type Flow Switches are not acceptable.**
 - j. air temperature.
2. Brazed Plate:
- a. Direct-expansion, single-pass, brazed-plate design.
 - b. Type 316 stainless-steel construction.
 - c. The evaporator shall be a compact, high efficiency, dual circuit, brazed plate-to-plate type heat exchanger consisting of parallel stainless-steel plates
 - d. Code Compliance: Tested and stamped according to ASME Boiler and Pressure Vessel Code.
 - e. Fluid Nozzles: Terminate with mechanical-coupling end connections for connection to field piping.
 - f. Evaporator shall have factory mounted strainer and chilled water flow switch.
 - g. The water-side working pressure shall be a minimum of 653 psig (4502 kPa). Vent and drain connections shall be provided in the inlet and outlet chilled water piping by the installing contractor. Evaporators shall be designed and constructed according to, and listed by, Underwriters Laboratories (UL).
 - h. The evaporator shall be protected with an electric resistance heater (heat trace tape) and insulated with 3/4" (19mm) thick closed-cell polyurethane insulation. This combination shall provide freeze protection down to -20°F (-29°C) ambient air temperature.
 - i. **Chiller shall have factory mounted Y-Strainer for Evaporator.**
 - j. **Chiller shall have factory mounted Thermal Dispersion Flow Switch (Paddle Type Flow Switches are not acceptable.**
3. Cooler Heater: Factory-installed and wired electric heater with integral controls designed to protect the evaporator to minus 20-degree F.

4. Remote Mounting: Designed for remote field mounting where indicated. Provide kit for field installation. Provide this option if noted on the schedule.

J. Air-Cooled Condenser:

1. Plate-fin coil with integral sub-cooling on each circuit, rated at 450 psig. Condenser fans shall be propeller type arranged for vertical air discharge and individually driven by direct-drive fan motors. The fans shall be equipped with a heavy-gauge vinyl-coated fan guard. Fan motors shall be TEAO type with permanently lubricated ball bearings, inherent overload protection, three-phase, direct-drive, 1140 rpm. Each fan section shall be partitioned to avoid cross circulation.
2. Coil shall be all aluminum alloy microchannel design and shall have a series of flat tubes containing multiple, parallel flow micro-channels layered between the refrigerant manifolds. Coils shall consist of a two-pass arrangement. Each condenser coil shall be factory leak tested with high-pressure air under water. Coils shall withstand 1000+ hour acidified synthetic sea water fog (SWAAT) test (ASTM G85-02) at 120°F (49°C) with 0% fin loss and develop no leaks.
 - a. Coat coils with a baked epoxy corrosion-resistant coating after fabrication if noted on the schedule.
 - b. Hail Protection: Provide condenser coils with louvers, baffles, or hoods to protect against hail damage.
2. Fans: Direct-drive variable speed ECM_propeller type with statically and dynamically balanced fan blades, arranged for vertical air discharge.
3. Fan Motors: Totally enclosed non-ventilating (TENV) or totally enclosed air over (TEAO) enclosure, with permanently lubricated bearings, and having built-in overcurrent- and thermal-overload protection.
4. Fan Guards: Steel safety guards with corrosion-resistant coating.

K. Electrical Power:

1. Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to water chiller.
2. House in a unit-mounted, NEMA 250, Type 3R enclosure with hinged access door with lock and key or padlock and key.
3. Wiring shall be numbered and color-coded to match wiring diagram.
4. Install factory wiring outside of an enclosure in a raceway.
5. Field power interface shall be heavy-duty, non-fused disconnect switch.
6. Provide branch power circuit to each motor and to controls with one of the following disconnecting means:
 - a. NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 60947-4-1.
 - b. NEMA KS 1, heavy-duty, non-fusible switch.
 - c. NEMA AB 1, motor-circuit protector (circuit breaker) with field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.

7. Provide each motor with overcurrent protection.
8. Overload relay sized according to UL 1995, or an integral component of water chiller control microprocessor.
9. Phase-Failure and Under-voltage: Solid-state sensing with adjustable settings.
10. Provide power factor correction capacitors to correct power factor to 0.95 at full load.
11. Transformer: Unit-mounted transformer with primary and secondary fuses and sized with enough capacity to operate electrical load plus spare capacity.
 - a. Power unit-mounted controls where indicated.
 - b. Power unit-mounted, ground fault interrupt (GFI) duplex receptacle.
12. Control Relays: Auxiliary and adjustable time-delay relays.
13. Indicate the following for water chiller electrical power supply:
 - a. Current, phase to phase, for all three phases.
 - b. Voltage, phase to phase and phase to neutral for all three phases.
 - c. Three-phase real power (kilowatts).
 - d. Three-phase reactive power (kilovolt amperes reactive).
 - e. 0.91 Power factor.
 - f. Running log of total power versus time (kilowatt hours).
 - g. Fault log, with time and date of each.
 - h. Ground fault protection.

L. Controls:

1. Stand-alone, microprocessor based.
2. A centrally located weatherproof control panel shall contain the field power connection points, control interlock terminals, and control system. Power and starting components shall include factory circuit breaker for fan motors and control circuit, individual contactors for each fan motor, solid-state compressor three-phase motor overload protection, inherent fan motor overload protection and two power blocks (one per circuit) for connection to remote, contractor supplied disconnect switches. Hinged access doors shall be lockable. Barrier panels or separate enclosures are required to protect against accidental contact with line voltage when accessing the control system.
3. Shall include optional single-point connection to a non-fused disconnect switch with through-the-door handle and compressor circuit breakers.

K. Unit Controller

1. An advanced DDC microprocessor unit controller with a minimum of 5-line by 22-character liquid crystal display provides the operating and protection functions. The controller shall take preemptive limiting action in case of high discharge pressure or low evaporator pressure. The controller shall contain the following features as a minimum:
2. The unit shall be protected in two ways: (1) by alarms that shut the unit down and require manual reset to restore unit operation and (2) by limit alarms that reduce unit operation in response to some out-of-limit condition. Shut down alarms shall activate an alarm signal.

3. Shutdown Alarms
 - a. No evaporator water flow (auto-restart)
 - b. Sensor failures
 - c. Low evaporator pressure
 - d. Evaporator freeze protection
 - e. High condenser pressure
 - f. Outside ambient temperature (auto-restart)
 - g. Motor protection system
 - h. Phase voltage protection

4. Limit Alarms
 - a. Condenser pressure stage down, unloads unit at high discharge pressures.
 - b. Low ambient lockout, shuts off unit at low ambient temperatures.
 - c. Low evaporator pressure hold, holds stage #1 until pressure rises.
 - d. Low evaporator pressure unload, shuts off one compressor.

5. Unit Enable Section
 - a. Enables unit operation from either local keypad, digital input, or BAS

6. Unit Mode Selection
 - a. Selects standard cooling, ice, glycol, or test operation mode

7. Analog Inputs:
 - a. Reset of leaving water temperature, 4-20 mA\
 - b. Current Limit

8. Digital Inputs
 - a. Unit off switch
 - b. Remote start/stop
 - c. Flow switch
 - d. Ice mode switch, converts operation and setpoints for ice production
 - e. Motor protection

9. Digital Outputs
 - a. Shutdown alarm; field wired, activates on an alarm condition, off when alarm is cleared
 - b. Evaporator pump; field hard wired, starts pump when unit is set to start

10. Condenser fan control - The unit controller shall provide control of condenser fans based on compressor discharge pressure.

11. Building Automation System (BAS) Interface

- a. Factory mounted DDC controller(s) shall support operation on a BACnet®, network via one of the data link / physical layers listed below as specified by the successful Building Automation System (BAS) supplier.
 - b. BACnet MS/TP master (Clause 9)
 - c. All communication from the chiller unit controller as specified in the points list shall be via standard BACnet objects. Proprietary BACnet objects shall not be allowed. BACnet communications shall conform to the BACnet protocol (ANSI/ASHRAE135-2001). A BACnet Protocol Implementation Conformance Statement (PICS) shall be provided along with the unit submittal.
 - d. Date and time.
 - e. Operating or alarm status.
 - f. Operating hours.
 - g. Outside-air temperature if required for chilled-water reset.
 - h. Temperature and pressure of operating set points.
 - i. Entering and leaving temperatures of chilled water.
 - j. Refrigerant pressures in evaporator and condenser.
 - k. Saturation temperature in evaporator and condenser.
 - l. No cooling load condition.
 - m. Elapsed time meter (compressor run status).
 - n. Pump status.
 - o. Anti-cycling timer status.
 - p. Percent of maximum motor amperage.
 - q. Current-limit set point.
 - r. Number of compressor starts.
3. Control Functions:
- a. Manual or automatic startup and shutdown time schedule.
 - b. Entering and leaving chilled-water temperatures, control set points, and motor load limit. Chilled-water leaving temperature shall be reset based on return-water, outside-air, or space temperature.
 - c. Current limit and demand limit.
 - d. External water chiller emergency stop.
 - e. Anti-cycling timer.
 - f. Automatic lead-lag switching.
4. Manual-Reset Safety Controls: The following conditions shall shut down water chiller and require manual reset:
- a. Low evaporator pressure or high condenser pressure.
 - b. Low chilled-water temperature.
 - c. Refrigerant high pressure.
 - d. High or low oil pressure.
 - e. High oil temperature.
 - f. Loss of chilled-water flow.
 - g. Control device failure.

M. Insulation:

1. Material: Closed-cell, flexible elastomeric, thermal insulation complying with ASTM C 534, Type I, for tubular materials and Type II, for sheet materials.
2. Thickness: 3/4 inch
3. Factory-applied insulation over cold surfaces of water chiller components.
 - a. Adhesive: As recommended by insulation manufacturer and applied to 100 percent of insulation contact surface. Seal seams and joints.
4. Apply protective coating to exposed surfaces of insulation.

N. **The following factory installed options must be provided:**

1. Replaceable Filter Dryer with Discharge & Liquid Valves with Electronic Expansion Valve.
2. Hot Gas Bypass on both circuits. Include factory-mounted hot gas bypass valve, solenoid valve, and manual shutoff valve for each circuit.
3. High ambient operation to 125 degree with auto start exhaust fan for control compartment. Control compartment shall be vented by an exhaust fan.
4. Refrigeration suction, discharge, and liquid isolation valves.
5. Single source power supply with none-fused disconnect switch with circuit protection. Electrical must be rated for 65 KAIC.
6. 1.5" evaporator and refrigerant pipe Insulation to Suction Compressor Tee.
7. Control transformer.
8. Security and hail guard metal louvers for condenser coil, compressor section and ends of the chiller. Wire grilles are not acceptable.
9. Low Ambient Control: condenser Fan VFD with operation down to -20°F.
10. Ground Fault Protection: Factory installed circuit breaker to protect equipment from damage from line-to-ground fault currents less than those required for conductor protection.
11. Phase loss with under/over voltage protection and with LED indication of the fault type to guard against compressor motor burnout.
12. Condenser Fan and Compressor Sound Reduction - Acoustic reduction blankets shall be factory installed on each compressor.
13. Thermal dispersion type flow switch.
14. Evaporator inlet strainer, 40-mesh with extension pipe and Victaulic couplings.
15. Field Powered 115V GFI convenience outlet
16. Chiller shall be shipped completely shrink wrapped for protection during shipment and keeping the coils clean. Contractor shall inspect the chiller for any damages.
17. Provide Rapid recovery option to recover from loss of power to full capacity in under 4 minutes, or achieve full capacity from stand-by in less than 2 minutes.
18. Provide intelligent management option with a 5 years subscription to allow 24/7 remote connection for control and monitoring the chiller.
19. Separate Trailer mounted Pump Skid
 - a. Each 20 hp pump shall be selected for 120 feet of head.
 - b. Pumps shall be mounted on the side of the chiller and piped to the evaporator.

- c. Pump package to be based on two skids mounted pumps w/isolation valves per each.
 - d. Water pressure gauges on the pump suction and discharge
 - e. Triple duty valve & Expansion Tank
 - f. Each Pump with ABB variable frequency drives and nema-4 enclosure
 - g. VFDs must be separate from the pumps.
 - h. All piping between the pumps and chiller to ne insulated with 2” thick insulation and have metal jacket.
 - i. Pump Package to have UL listing.
 - j. Pumps to be hard wire interlocked to the chiller.
20. Transformer
- k. Provide a 240/3/60 to 460/3/60 transformer.
 - l. Transformer shall be mounted on the trailer and wired to the chiller to allow switching voltage as needed.
 - m. Provide disconnects and quick connect on both sides.
 - n. Provide 100” of power wire.
 - o. All wiring must be in conduit and meet local code.
21. Trailer
- p. Trailer must be selected to handle Chiller, Pump Skid, Transformer weight.
 - q. Trailer shall have minimum of four large storage containers with locking kit.
22. Hoses
- r. Provide 200 feet of heavy duty 6” hoses.
 - s. Provide inner connecting fittings.
 - t. Provide isolation valves and fittings.
 - u. Provide four (4) 6” to 4” reducers

L. Additional accessories shall be provided:

- a. Rubber-in-shear vibration isolators for field installation
- b. Cottonwood filters for entire chiller.

3.3 SOURCE QUALITY CONTROL

- A. Perform functional test of water chillers before shipping.
- B. Factory test and inspect evaporator according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1. Stamp with ASME label.
- C. For water chillers located outdoors, rate sound power level according to ARI 370 procedure.
- D. Chiller shall be shipped completely shrink wrapped for protection during shipment and keeping the coils clean. Contractor shall inspect the chiller for any damages.

PART 4 - EXECUTION

4.1 WATER CHILLER INSTALLATION

- A. Install water chillers on support structure indicated.
- B. Chilled water pumps shall be hard wire interlock to chiller control panel.
- C. Flow switch must be installed downstream of the evaporator and wired to chiller terminal controller.
- D. Installing contractor shall provide a copy of pre-startup check list to manufacturer 10 day prior to chiller startup date.
- E. Provide a copy of final startup report to the owner.
- F. System must be completely flushed and cleaned before water flowing through the evaporator.
- G. Clean condenser coils if needed prior to chiller startup.
- H. Installing contractor shall hard wire interlock chiller pump to chiller terminals.
- I. A 2-position motorized valve shall be installed for each chiller to prevent water flowing through the chiller if chiller is off when a common pipe is used for multiple chillers.
- J. Installing contractor must install a strainer at the chiller and upfront of the evaporator
- K. Equipment Mounting: Install water chiller on concrete bases using elastomeric pads Comply with requirements in Division 3 Section Concrete. Comply with requirements for vibration isolation devices specified in Division 15 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."
 - 1. Minimum Deflection: 1 inch
 - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
 - 3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - 4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
- L. Equipment Mounting: Install water chiller using elastomeric pads isolators. Comply with requirements for vibration isolation devices specified in Division 15 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."
 - 1. Minimum Deflection: 1 inch.
- M. Equipment Mounting: Install water chiller on vibration isolation inertia bases. Comply with requirements specified in Division 15 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

- N. Equipment Mounting: Install water chiller on concrete bases. Comply with requirements in Division 3 Section Cast-in-Place Concrete.
 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
 2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
- O. Maintain manufacturer's recommended clearances for service and maintenance.
- P. Charge water chiller with refrigerant if not factory charged and fill with oil if not factory installed.
- Q. Install separate devices furnished by manufacturer and not factory installed.

4.2 CONNECTIONS

- A. Comply with requirements in Division 15 Section "Hydronic Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to chiller to allow service and maintenance.
- C. Evaporator Fluid Connections: Connect to evaporator inlet with shutoff valve, strainer at the chiller and upstream of the evaporator, flexible connector, thermometer, and plugged tee with pressure gage. Connect to evaporator outlet with shutoff valve, balancing valve, flexible connector, flow switch, thermometer, plugged tee with pressure gage, and drain connection with valve. Make connections to water chiller with a flanges.
- D. Connect each drain connection with a union and drain pipe and extend pipe, full size of connection, to floor drain. Provide a shutoff valve at each connection if required.
- E. Contractor shall install temporary chiller connection taps and isolation valve for every school.

4.3 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
- B. Inspect field-assembled components, equipment installation, and piping and electrical connections for proper assemblies, installations, and connections.
- C. Complete installation and startup checks according to manufacturer's written instructions and perform the following:
 1. Verify that refrigerant charge is sufficient and water chiller has been leak tested.
 2. Verify that pumps are installed and functional.
 3. Verify that thermometers and gages are installed.

4. Operate water chiller for run-in period.
5. Check bearing lubrication and oil levels.
6. Verify proper motor rotation.
7. Verify static deflection of vibration isolators, including deflection during water chiller startup and shutdown.
8. Verify and record performance of chilled-water flow and low-temperature interlocks.
9. Verify and record performance of water chiller protection devices.
10. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.

D. Prepare a written startup report that provides results of tests and inspections.

END OF SECTION 236423