SECTION 238146 - WATER-SOURCE UNITARY HEAT PUMPS

Revise this Section by deleting and inserting text to meet Project-specific requirements.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

1. GENERAL
	* + 1. RELATED DOCUMENTS

Retain or delete this article in all Sections of Project Manual.

* + - * 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
			1. SUMMARY
				1. Section includes unitary heat pumps with refrigerant-to-water heat exchangers, refrigeration circuits, and refrigerant compressor(s).
			2. SUBMITTALS
				1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
				2. Manufacturer’s installation instructions shall be provided along with product data.
				3. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
				4. Product Data: For each type of product.

Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each water-source unitary heat pump.

Include rated capacities, operating characteristics, furnished specialties, and accessories.

* + - * 1. Shop Drawings:

Include plans, elevations, sections, and mounting and attachment details.

Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

Include diagrams for power, signal, and control wiring.

Retain "Seismic Qualification Certificates" paragraph below if required by seismic criteria applicable to Project. Coordinate with Section 230548 "Vibration and Seismic Controls for HVAC" or Section 230548.13 "Vibration Controls for HVAC." See ASCE/SEI 7 for certification requirements for equipment and components.

* + - * 1. Seismic Qualification Certificates: For water-source unitary heat pumps, accessories, and components, from manufacturer.

Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

Retain "Product Certificates" paragraph below to require submittal of product certificates from manufacturers.

* + - * 1. Product Certificates: For each type of water-source unitary heat pump, signed by product manufacturer.

Retain "Field quality-control reports" paragraph below if Contractor is responsible for field quality-control testing and inspecting.

* + - * 1. Field quality-control reports.
				2. Sample Warranty: For manufacturer's warranty.
			1. CLOSEOUT SUBMITTALS
				1. Operation and Maintenance Data: For water-source unitary heat pumps to include in emergency, operation, and maintenance manuals.
			2. MAINTENANCE MATERIAL SUBMITTALS

Extra materials may not be allowed for publicly funded projects.

* + - * 1. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

Revise subparagraph below to suit Project.

**[One] <Insert number>** spare heat-pump unit(s) of each size and model furnished.

* + - 1. WARRANTY

When warranties are required, verify with Director’s Representative's that warranties stated in this article are not less than remedies available to Director’s Representative under prevailing local laws.

* + - * 1. Special Warranty: Manufacturer agrees to repair or replace components of water-source unitary heat pumps that fail in materials or workmanship within specified warranty period.

Failures include, but are not limited to, refrigeration components.

Verify available warranties and warranty periods for refrigerant components.

Warranty Period: **[Four] <Insert number>** years from date of Substantial Completion.

1. PRODUCTS

See Editing Instruction No. 1 in the Evaluations for cautions about named manufacturers and products. For an explanation of options and Contractor's product selection procedures, see Section 016000 "Product Requirements."

* + - 1. PERFORMANCE REQUIREMENTS

"ASHRAE Compliance" paragraph below may be required to comply with Project requirements or authorities having jurisdiction. Verify, with manufacturers, availability of units with components and features that comply with these requirements.

* + - * 1. ASHRAE Compliance:

ASHRAE 15.

* + - * 1. Comply with NFPA 70.
				2. Comply with safety requirements in UL 484 for assembly of free-delivery, water-source heat pumps.
			1. WATER-SOURCE UNITARY HEAT PUMPS, 6 TONS AND SMALLER

Many optional features are available for this product, and some optional features are mutually exclusive from each other. Specify all those required for Project.

* + - * 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

Carrier Global Corporation.

ClimateMaster, Inc.

Daikin-McQuay.

Trane Inc.

York.

Approved equivalent.

* + - * 1. Description: Packaged water-source unitary heat pump with temperature controls; factory assembled, piped, wired, tested, and rated according to ASHRAE/ARI/ISO-13256-1.

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.

* + - * 1. Cabinet and Chassis: Galvanized-steel casing with the following features:

Access panel for access and maintenance of internal components.

Knockouts for electrical and piping connections.

Cabinet Insulation: Glass-fiber liner, minimum [1/2 inch], [3/4 inch] thick, complying with UL 181, ASTM C1071, and ASTM G21.

* + - * 1. Water Circuits:

Refrigerant-to-Water Heat Exchangers:

Retain one of first two subparagraphs below.

Source-side coaxial heat exchangers with **[copper] [cupronickel] [internal vented double wall]** water tube, with enhanced heat-transfer surfaces inside a steel shell; both shell and tube are leak tested to 450 psig on refrigerant side and 400 psig on water side.

Load-side coaxial heat exchangers with **[copper] [cupronickel]** water tube, with enhanced heat-transfer surfaces inside a steel shell; both shell and tube are leak tested to 450 psig on refrigerant side and 400 psig on water side.

Stainless-steel, brazed-plate heat exchanger is leak tested to 450 psig on refrigerant side and 400 psig on water side. Factory mount heat exchanger in unit on resilient rubber vibration isolators.

Hot-water generator, **[copper water tube] [vented double wall copper tube]** with enhanced heat-transfer surfaces inside a steel shell; both shell and tube are leak tested to 450 psig on refrigerant side and 400 psig on water side, pump, circuit breaker, high water temperature and low water refrigerant cutoffs, and tank connection.

Verify availability of water-regulating valves and motorized water valves.

* + - * 1. Refrigerant Circuit Components:

Sealed Refrigerant Circuit: Charge with R-410A refrigerant.

Filter-dryers are unavailable from some manufacturers.

Filter-Dryer: Factory installed to clean and dehydrate the refrigerant circuit.

Charging Connections: Service fittings on suction and liquid for charging and testing on each circuit.

Reversing Valve: Four-way, solenoid-activated valve designed to be fail-safe in heating position with replaceable magnetic coil.

Options in "Compressor" subparagraph below depend on unit size. Verify with manufacturers. Delete if these features are not specific selection criteria.

Compressor:

Scroll.

**[Single stage] [Two stage] [Variable speed]**.

Installed on vibration isolators and mounted on a structural steel base plate and full-length channel stiffeners.

Exterior of compressor shall be wrapped with a high-density sound-attenuating blanket and housed in an acoustically treated enclosure.

Factory-Installed Safeties:

Antirecycle timer.

High-pressure cutout.

Low-pressure cutout or loss of charge switch.

Internal thermal-overload protection.

Retain first two subparagraphs below for compressor safety switches.

Freezestat to stop compressor if water-loop temperature in refrigerant-to-water heat exchanger falls below **[35 deg F] <Insert temperature>**.

Water-coil, low-temperature switch.

Refrigerant Piping Materials: ASTM B743 copper tube with wrought-copper fittings and brazed joints.

Pipe Insulation: Refrigerant minimum 3/8-inch- thick, flexible elastomeric insulation on piping exposed to airflow through the unit. Maximum 25/50 flame-spread/smoke-developed indexes according to ASTM E84.

Retain one of two "Refrigerant Metering Device" subparagraphs below.

Refrigerant Metering Device: Thermal-expansion valve.

Refrigerant Metering Device: Dual-port, thermal-expansion valve to allow specified operation with entering-water temperatures from **[25 to 125 deg F] <Insert temperature range>**.

Retain one of two "Controls" paragraphs below. Retain first paragraph if controls are part of a DDC temperature-control system.

* + - * 1. Controls: Control equipment and sequence of operation are specified in Section 230923 "Direct Digital Control (DDC) System for HVAC" and Section 230993.11 "Sequence of Operations for HVAC DDC."
				2. Controls:

Basic Unit Control Modes and Devices:

Unit shutdown on high or low refrigerant pressures.

Unit shutdown on low water temperature.

Low- and high-voltage protection.

Overcurrent protection for compressor.

Random time delay, three to 10 seconds, start on power-up.

Time delay override for servicing.

Control voltage transformer.

Water-coil freeze protection (selectable for water or antifreeze).

Automatic intelligent reset. Unit shall automatically reset five minutes after trip if the fault has cleared. Should a fault reoccur three times sequentially, lockout requiring manual reset occurs.

Ability to defeat time delays for servicing.

Digital display to indicate high pressure, low pressure, low voltage, and high voltage.

The low-pressure switch shall not be monitored for the first 90 seconds after a compressor start command to prevent nuisance safety trips.

Remote fault-type indication at thermostat.

Selectable 24-V dc or pilot duty dry contact alarm output.

24-V dc output to cycle a motorized water valve with compressor contactor.

Service test mode for troubleshooting and service.

Unit-performance sentinel warns when heat pump is running inefficiently.

Compressor soft start.

Thermostat:

Wall-Mounted Thermostat:

Heat-cool-off switch.

**[Five day] [Seven day]**, programmable.

**[Manual] [Automatic]** changeover.

**[Concealed] [Exposed]** temperature set point.

**[Concealed] [Exposed]** temperature indication.

Deg **[F] [C]** indication.

Wall-mounted temperature sensor.

Duct-mounted temperature sensor

Unoccupied period override push button.

Digital display to indicate fault condition at heat pump.

Data entry and access port.

Input data include room temperature and humidity set points for occupied and unoccupied periods.

Output data include room temperature and humidity, supply-air temperature, entering-water temperature, operating mode, and status.

Terminal Controller:

Scheduled operation for occupied and unoccupied periods on **[seven] [365]**-day clock with minimum of four programmable periods per day.

**[Two] <Insert number>**-hour unoccupied override period.

Remote-control panel to contain programmable timer and digital display for fault condition.

Compressor-disable relay to stop compressor operation for demand limiting or switch to unoccupied operation.

Automatic restart after five minutes if fault clears. Lockout after three attempts to restart following fault. Indicate fault for service technician.

Backup for volatile memory.

DDC interface requirements as further described in Section 230923 "Direct Digital Control (DDC) System for HVAC" and Section 230993.11 "Sequence of Operations for HVAC DDC."

Interface relay for scheduled operation.

Interface relay to provide indication of fault at central workstation.

Provide **[BAC-net] [or] [LonWorks]** interface for central DDC workstation for the following functions:

Set-point adjustment.

Start/stop and operating status of heat-pump unit.

Data inquiry to include supply-air and room-air temperature and humidity, and entering-water temperature.

Occupied and unoccupied schedules.

* + - * 1. Electrical Connection: Single electrical connection**[ with fused disconnect]**.

If Project has more than one of this type of heat pump, delete "Capacities and Characteristics" paragraph below and schedule heat pumps on Drawings.

* + - * 1. Capacities and Characteristics:

Source-Side Water Supply:

Water Flow: **<Insert gpm>**.

Pressure Loss: **<Insert feet wg>**.

Entering-Water Temperature (Cooling): **<Insert deg F>**.

Entering-Water Temperature (Heating): **<Insert deg F>**.

Antifreeze Protection Chemical: **<Insert chemical name>**.

Antifreeze Concentration: **<Insert percentage>**.

Load-Side Water Supply:

Water Flow: **<Insert gpm>**.

Pressure Loss: **<Insert feet wg>**.

Entering-Water Temperature (Cooling): **<Insert deg F>**.

Entering-Water Temperature (Heating): **<Insert deg F>**.

Antifreeze Protection Chemical: **<Insert chemical name>**.

Antifreeze Concentration: **<Insert percentage>**.

Cooling:

Total Capacity: **<Insert Btu/h>**.

Sensible Capacity: **<Insert Btu/h>**.

Sustainability ratings require minimum efficiency equal to requirements in ASHRAE/IES 90.1, Table 6.8.1B, "Electrically Operated Unitary and Applied Heat Pumps - Minimum Efficiency Requirements."

Minimum Energy-Efficiency Ratio (EER): **<Insert value>**.

Heating:

Capacity: **<Insert Btu/h>**.

Sustainability ratings require minimum efficiency equal to requirements in ASHRAE/IES 90.1, Table 6.8.1B, "Electrically Operated Unitary and Applied Heat Pumps - Minimum Efficiency Requirements."

Minimum Coefficient of Performance (COP): **<Insert value>**.

Electrical Characteristics for Single Connection:

Volts: **[120] [208] [230] <Insert number>** V.

Phase: **[Single] [Three]**.

Hertz: 60.

Full-Load Amperes (FLA): **<Insert number>** A.

Maximum Circuit Amperage (MCA): **<Insert number>** A.

Maximum Overcurrent Protection (MOCP): **<Insert number>** A.

* + - 1. WATER-SOURCE UNITARY HEAT PUMPS LARGER THAN 6 TONS

Many optional features are available for this product, and some are mutually exclusive. Specify all those required for Project.

* + - * 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

Carrier Global Corporation.

ClimateMaster, Inc.

Daikin-McQuay.

Trane.

York.

Approved equivalent.

* + - * 1. Description: Packaged water-source unitary heat pump with temperature controls; factory assembled, piped, wired, tested, and rated according to ASHRAE/ARI/ISO-13256-1.

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.

* + - * 1. Cabinet and Chassis: Galvanized-steel casing with the following features:

Access panel for access and maintenance of internal components.

Knockouts for electrical and piping connections.

Cabinet Insulation: Glass-fiber liner, minimum **[1/2 inch], [3/4 inch]** thick, complying with UL 181, ASTM C1071, and ASTM G21.

* + - * 1. Water Circuits:

Refrigerant-to-Water Heat Exchangers:

Retain one of first two subparagraphs below.

Source-side coaxial heat exchangers with **[copper] [cupronickel] [internal vented double wall]** water tube, with enhanced heat-transfer surfaces inside a steel shell; both shell and tube are leak tested to 450 psig on refrigerant side and 400 psig on water side.

Load-side coaxial heat exchangers with **[copper] [cupronickel]** water tube, with enhanced heat-transfer surfaces inside a steel shell; both shell and tube are leak tested to 450 psig on refrigerant side and 400 psig on water side.

Stainless-steel, brazed-plate heat exchanger is leak tested to 450 psig on refrigerant side and 400 psig on water side. Factory mount heat exchanger in unit on resilient rubber vibration isolators.

Hot-water generator, **[copper water tube] [vented double wall copper tube]** with enhanced heat-transfer surfaces inside a steel shell; both shell and tube are leak tested to 450 psig on refrigerant side and 400 psig on water side, pump, circuit breaker, high water temperature and low water refrigerant cutoffs, and tank connection.

Verify availability of water-regulating valves and motorized water valves.

* + - * 1. Refrigerant Circuit Components:

Sealed Refrigerant Circuit: Charge with R-410A refrigerant.

Filter-dryers are unavailable from some manufacturers.

Filter-Dryer: Factory installed to clean and dehydrate the refrigerant circuit.

Charging Connections: Service fittings on suction and liquid for charging and testing on each circuit.

Reversing Valve: Four-way, solenoid-activated valve designed to be fail-safe in heating position with replaceable magnetic coil.

Options in "Compressor" subparagraph below depend on unit size. Verify with manufacturers. Delete if these features are not specific selection criteria.

Compressor:

Scroll.

**[Single stage] [Two stage] [Variable speed]**.

Installed on vibration isolators and mounted on a structural steel base plate and full-length channel stiffeners.

Exterior of compressor shall be wrapped with a high-density sound-attenuating blanket and housed in an acoustically treated enclosure.

Factory-Installed Safeties:

Antirecycle timer.

High-pressure cutout.

Low-pressure cutout or loss of charge switch.

Internal thermal-overload protection.

Retain first two subparagraphs below for compressor safety switches.

Freezestat to stop compressor if water-loop temperature in refrigerant-to-water heat exchanger falls below **[35 deg F] <Insert temperature>**.

Water-coil, low-temperature switch.

Refrigerant Piping Materials: ASTM B743 copper tube with wrought-copper fittings and brazed joints.

Pipe Insulation: Refrigerant minimum 3/8-inch- thick, flexible elastomeric insulation on piping exposed to airflow through the unit. Maximum 25/50 flame-spread/smoke-developed indexes according to ASTM E84.

Retain one of two "Refrigerant Metering Device" subparagraphs below.

Refrigerant Metering Device: Thermal-expansion valve.

Refrigerant Metering Device: Dual-port, thermal-expansion valve to allow specified operation with entering-water temperatures from **[25 to 125 deg F] <Insert temperature range>**.

Retain first "Controls" paragraph below if controls are part of a DDC temperature-control system.

* + - * 1. Controls: Control equipment and sequence of operation are specified in Section 230923 "Direct Digital Control (DDC) System for HVAC" and Section 230993.11 "Sequence of Operations for HVAC DDC."

Retain "Controls" paragraph below if controls are not part of a DDC temperature-control system.

* + - * 1. Controls:

Basic Unit Control Modes and Devices:

Unit shutdown on high or low refrigerant pressures.

Unit shutdown on low water temperature.

Low- and high-voltage protection.

Overcurrent protection for compressor.

Random time delay, three to 10 seconds, start on power-up.

Time delay override for servicing.

Control voltage transformer.

Water-coil freeze protection (selectable for water or antifreeze).

Automatic intelligent reset. Unit shall automatically reset five minutes after trip if the fault has cleared. Should a fault reoccur three times sequentially, lockout requiring manual reset occurs.

Ability to defeat time delays for servicing.

Digital display to indicate high pressure, low pressure, low voltage, and high voltage.

The low-pressure switch shall not be monitored for the first 90 seconds after a compressor start command to prevent nuisance safety trips.

Remote fault-type indication at thermostat.

Selectable 24-V dc or pilot duty dry contact alarm output.

24-V dc output to cycle a motorized water valve with compressor contactor.

Service test mode for troubleshooting and service.

Unit-performance sentinel warns when heat pump is running inefficiently.

Compressor soft start.

Thermostat:

Wall-Mounted Thermostat:

Heat-cool-off switch.

**[Five day] [Seven day]**, programmable

**[Manual] [Automatic]** changeover.

**[Concealed] [Exposed]** temperature set point.

**[Concealed] [Exposed]** temperature indication.

Deg **[F] [C]** indication.

Wall-mounted temperature sensor.

Duct-mounted temperature sensor

Unoccupied period override push button.

Digital display to indicate fault condition at heat pump.

Data entry and access port.

Input data include room temperature and humidity set points for occupied and unoccupied periods.

Output data include room temperature and humidity, supply-air temperature, entering-water temperature, operating mode, and status.

Terminal Controller:

Scheduled operation for occupied and unoccupied periods on **[seven] [365]**-day clock with minimum of four programmable periods per day.

**[Two] <Insert number>**-hour unoccupied override period.

Remote-control panel to contain programmable timer and digital display for fault condition.

Compressor-disable relay to stop compressor operation for demand limiting or switch to unoccupied operation.

Automatic restart after five minutes if fault clears. Lockout after three attempts to restart following fault. Indicate fault for service technician.

Backup for volatile memory.

DDC interface requirements as further described in Section 230923 "Direct Digital Control (DDC) System for HVAC" and Section 230993.11 "Sequence of Operations for HVAC DDC."

Interface relay for scheduled operation.

Interface relay to provide indication of fault at central workstation.

Provide **[BAC-net] [or] [LonWorks]** interface for central DDC workstation for the following functions:

Set-point adjustment.

Start/stop and operating status of heat-pump unit.

Data inquiry to include supply-air and room-air temperature and humidity, and entering-water temperature.

Occupied and unoccupied schedules.

* + - * 1. Electrical Connection: Single electrical connection**[ with fused disconnect]**.

If Project has more than one of this type of heat pump, delete "Capacities and Characteristics" paragraph below and schedule heat pumps on Drawings.

* + - * 1. Capacities and Characteristics:

Source-Side Water Supply:

Water Flow: **<Insert gpm>**.

Pressure Loss: **<Insert feet wg>**.

Entering-Water Temperature (Cooling): **<Insert deg F>**.

Entering-Water Temperature (Heating): **<Insert deg F>**.

Antifreeze Protection Chemical: **<Insert chemical name>**.

Antifreeze Concentration: **<Insert percentage>**.

Load-Side Water Supply:

Water Flow: **<Insert gpm>**.

Pressure Loss: **<Insert feet wg>**.

Entering-Water Temperature (Cooling): **<Insert deg F>**.

Entering-Water Temperature (Heating): **<Insert deg F>**.

Antifreeze Protection Chemical: **<Insert chemical name>**.

Antifreeze Concentration: **<Insert percentage>**.

Cooling:

Total Capacity: **<Insert Btu/h>**.

Sensible Capacity: **<Insert Btu/h>**.

Sustainability ratings require minimum efficiency equal to requirements in ASHRAE/IES 90.1, Table 6.8.1B, "Electrically Operated Unitary and Applied Heat Pumps - Minimum Efficiency Requirements."

Minimum Energy-Efficiency Ratio (EER): **<Insert value>**.

Heating:

Capacity: **<Insert Btu/h>**.

Sustainability ratings require minimum efficiency equal to requirements in ASHRAE/IES 90.1, Table 6.8.1B, "Electrically Operated Unitary and Applied Heat Pumps - Minimum Efficiency Requirements."

Minimum Coefficient of Performance (COP): **<Insert value>**.

Electrical Characteristics for Single Connection:

Volts: **[120] [208] [230] <Insert number>** V.

Phase: **[Single] [Three]**.

Hertz: 60.

Full-Load Amperes (FLA): **<Insert number>** A.

Maximum Circuit Amperage (MCA): **<Insert number>** A.

Maximum Overcurrent Protection (MOCP): **<Insert number>** A.

* + - 1. ACCESSORIES

Retain either "Hose Kits" paragraph or "Hose Kit Assemblies" paragraph below. Retain "Hose Kits" paragraph below if hose kits are furnished with the water-source unitary heat pumps.

* + - * 1. Hose Kits: Tag hose kits to equipment designations.

Minimum Working Pressure: 400 psig.

Operating Temperatures: From 33 to 211 deg F.

Hose Length: **[24 inches] [36 inches] <Insert dimension>**.

Minimum Hose Diameter: Equal to water-source unitary heat-pump piping connection.

Hose Material: Braided stainless steel with adapters for pipe connections.

Isolation Valves: Two-piece, bronze-body ball valves with stainless-steel ball and stem, standard-port threaded connections, and galvanized-steel lever handle. Valves shall be factory installed on supply and return connections of both load-side and source-side heat exchangers. If balancing valve is combination shutoff type with memory stop, the isolation valve may be omitted on the return.

Strainer: Y-pattern with blowdown valve in supply connections of both load and source side of heat exchangers.

Balancing Valves: Mount in return connection. Include meter ports to allow flow measurement with differential pressure gage.

Retain one of first three subparagraphs below.

Automatic balancing valve, factory set to operate within 10 percent of design flow rate over a pressure range of 2 to 80 psig.

Manual, calibrated-orifice balancing valve with memory stop.

Manual, venturi-type balancing valve with memory stop.

Water-Regulating Valve Assemblies: A direct acting valve regulates discharge pressure during the cooling cycle, and a reverse acting valve regulates the suction pressure during the heating cycle. Valves shall close when heat-pump compressor is not running.

Motorized Water Valve: Stop water flow through the unit when compressor is off. Slow-acting, 24-V dc valve with threaded connections is installed between isolation valves and heat exchanger.

Retain "Hose Kit Assemblies" paragraph if hoses kits are not furnished separately from the water-source unitary heat pumps.

* + - * 1. Hose Kit Assemblies:

Minimum Working Pressure: 400-psig.

Operating Temperatures: From 33 to 211 deg F.

Hose Length: **[24 inches] [36 inches] <Insert dimension>**.

Minimum Hose Diameter: Equal to water-source unitary heat-pump piping connection.

Hose Material: Braided stainless steel with adapters for pipe connections.

Retain one or more of four subparagraphs below.

Supply and return hoses having ball valve with pressure-temperature port.

Supply hose having ball valve with pressure-temperature port; return hose having automatic flow regulator valve with pressure-temperature ports and ball valve.

Supply hose having Y-pattern strainer with blowdown valve and ball valve with pressure-temperature port; return hose having automatic flow regulator with pressure-temperature ports and ball valve.

Supply hose having Y-pattern strainer with blowdown valve and ball valve with pressure-temperature port; return hose having ball valve with pressure-temperature port.

* + - * 1. Loop Controller: Six stages; two stages for heating and four stages for cooling.

Retain "Pump Module" paragraph below for individual heat pumps that either stand alone or are secondary to a central circulating water loop.

* + - * 1. Pump Module:

Values in first subparagraph below are examples only; verify actual values with manufacturer.

Minimum **[1/6-hp] <Insert motor size>, [230-V] [120-V]**, single-phase pump, rated for at least **[16 gpm] <Insert value>** at **[20 feet of head] <Insert value>**.

Motor characteristics such as NEMA designation, temperature rating, service factor, enclosure type, and efficiency are specified in Section 230513 "Common Motor Requirements for HVAC Equipment." If different characteristics are required, add subparagraphs below to suit Project.

General requirements for motors are specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

Include pump module hose kit with thread to barb fittings, hose, and hose clamps.

Three-way brass shut-off/flushing/purging valve.

Include controls to operate pump as required to maintain room temperature and ventilation set points.

1. EXECUTION
	* + 1. EXAMINATION
				1. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
				2. Examine roughing-in for piping and electric installations for water-source unitary heat pumps to verify actual locations of piping connections and electrical conduits before installation.
				3. Proceed with installation only after unsatisfactory conditions have been corrected.
			2. INSTALLATION

Retain "Equipment Mounting" paragraph below if units are floor mounted.

* + - * 1. Equipment Mounting:

Retain first subparagraph below to require equipment to be installed on cast-in-place concrete equipment bases.

Install water-source, unitary heat pumps on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."

Retain one of two subparagraphs below. Retain first for projects in seismic areas; retain second for projects not in seismic areas. Indicate vibration-isolation and seismic-restraint device type and minimum deflection in supported equipment schedule on Drawings.

Comply with requirements for vibration-isolation and seismic-restraint devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."

Comply with requirements for vibration-isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."

Retain first paragraph below if units are suspended from structure.

* + - * 1. Suspend water-source, unitary heat pumps from structure with all-thread hanger rods and **[elastomeric hangers] [spring hangers] [spring hangers with vertical-limit stop]**. Hanger rods and attachments to structure are specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment." Vibration hangers are specified in **[Section 230548 "Vibration and Seismic Controls for HVAC."] [Section 230548.13 "Vibration Controls for HVAC."]**
				2. Install wall-mounting thermostats and switch controls in electrical outlet boxes at heights to match lighting controls or as required in Section 230923 "Direct Digital Control (DDC) System for HVAC."
			1. CONNECTIONS

Coordinate requirements for piping installation and specialty arrangements with Drawings and with requirements specified in hydronic piping and steam and condensate piping systems. If Drawings are explicit enough, these requirements may be reduced or omitted.

* + - * 1. Drawings indicate general arrangement of piping, fittings, and specialties. Specific connection requirements are as follows:

Connect supply and return hydronic piping to heat pump with **[unions and shutoff valves] [hose kits]**.

Coordinate duct installation requirements with Drawings and with requirements specified for duct systems. If Drawings are explicit enough, these requirements may be reduced or omitted.

* + - * 1. Install electrical devices furnished by manufacturer but not specified to be factory mounted.
				2. Install piping adjacent to machine to allow space for service and maintenance.
			1. FIELD QUALITY CONTROL

Retain "Manufacturer's Field Service" paragraph below to require a factory-authorized service representative to perform tests and inspections.

* + - * 1. Manufacturer's Field Service: Engage a Company Service Advisor per OGS Spec Section 014216 to test and inspect components, assemblies, and equipment installations, including connections.

Retain "Perform the following tests and inspections" paragraph below to require Contractor to perform tests and inspections.

* + - * 1. Perform the following field tests and inspections:

After installing water to water heat pumps and after electrical circuitry has been energized, test units for compliance with requirements.

Inspect for and remove shipping bolts, blocks, and tie-down straps.

Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

* + - * 1. Heat pumps will be considered defective if they do not pass tests and inspections.
				2. Prepare test and inspection reports.
			1. STARTUP SERVICE

Delete paragraph below if factory-authorized service representative is not required.

* + - * 1. **[Engage a Company Service Advisor per OGS Spec Section 014216 to perform] [Perform]** startup service.

Complete installation and startup checks according to manufacturer's written instructions.

Inspect for visible damage to unit casing.

Inspect for visible damage to compressor and coils.

Inspect internal insulation.

Verify that labels are clearly visible.

Verify that clearances have been provided for servicing.

Verify that controls are connected and operable.

Adjust vibration isolators.

Start unit according to manufacturer's written instructions.

Complete startup sheets and attach copy with Contractor's startup report.

Inspect and record performance of interlocks and protective devices; verify sequences.

Operate unit for an initial period as recommended or required by manufacturer.

Verify thermostat calibration.

Inspect controls for correct sequencing of heating, refrigeration, and normal and emergency shutdown.

* + - 1. ADJUSTING
				1. Adjust initial temperature set points.
				2. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
				3. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to **[two] <Insert number>** visits to Project during other-than-normal occupancy hours for this purpose.
			2. DEMONSTRATION
				1. **[Engage a Company Service Advisor per OGS Spec Section 014216 to train] [Train]** Director’s Representative's Facility’s maintenance personnel to adjust, operate, and maintain water-source unitary heat pumps.

END OF SECTION 238146