

**SECTION 23 22 23
STEAM CONDENSATE PUMPS**

SPEC WRITER NOTE: Delete between // // if not applicable to project. Also delete any other item or paragraph not applicable in the Section and renumber the paragraph.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Steam condensate pumps for Heating, Ventilating and Air Conditioning.
- B. Definitions:
 - 1. Capacity: Liters per second (L/s) (Gallons per minute (gpm)) of the fluid pumped.
 - 2. Head: Total dynamic head in kPa (feet) of the fluid pumped.
- C. A complete listing of common acronyms and abbreviations are included in //Section 23 05 10, COMMON WORK RESULTS FOR BOILER PLANT AND STEAM GENERATION// //Section 23 05 11, COMMON WORK RESULTS FOR HVAC//.

1.2 RELATED WORK

- A. Section 01 00 00, GENERAL REQUIREMENTS.
- B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.
- D. //Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.//
- E. //Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.//
- F. //Section 23 05 10, COMMON WORK RESULTS FOR BOILER PLANT AND STEAM GENERATION.//
- G. //Section 23 05 11, COMMON WORK RESULTS FOR HVAC.//
- H. Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION EQUIPMENT.
- I. Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.
- J. //Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.//
- K. Section 23 22 13, STEAM AND CONDENSATE HEATING PIPING.

1.3 SUBMITTALS

- A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

- B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 23 22 23, STEAM CONDENSATE PUMPS", with applicable paragraph identification.
- C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
 - 1. Pumps and accessories.
 - 2. Motors and drives.
- D. Characteristic Curves: Head-capacity, efficiency-capacity, brake horsepower-capacity, and NPSHR-capacity for each pump //and if specified, for dual parallel pump operation//.
- E. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replacement parts, and troubleshooting guide:
 - 1. Include complete list indicating all components of the systems.
 - 2. Include complete diagrams of the internal wiring for each item of equipment.
 - 3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.
- F. //Completed System Readiness Checklist provided by the Commissioning Agent and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.//
- G. //Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.//

1.4 QUALITY ASSURANCE

- A. Design Criteria:
 - 1. Pumps design and manufacturer shall conform to Hydraulic Institute Standards.
 - 2. Pump sizes, capacities, pressures, operating characteristics and efficiency shall be as scheduled.
 - 3. Select pumps so that required net positive suction head (NPSHR) does not exceed the net positive head available (NPSHA).
 - 4. Pump Driver: Furnish with pump. Size shall be non-overloading at any point on the head-capacity curve including one pump operation in a parallel or series pumping installation.

5. Provide all electric-powered pumps with motors, impellers, drive assemblies, bearings, coupling guard and other accessories specified. Statically and dynamically balance all rotating parts.
6. Furnish each pump and motor with a nameplate giving the manufacturers name, serial number of pump, capacity in gpm and head in feet at design condition, horsepower, voltage, frequency, speed and full load current and motor efficiency.
7. Test all pumps before shipment. The manufacturer shall certify all pump ratings.
8. After completion of balancing, provide replacement of impellers or trim impellers to provide specified flow at actual pumping head, as installed.
9. Furnish one spare seal and casing gasket for each pump to the
 //(COR)// //Project Manager//.

B. Allowable Vibration Tolerance for Pump Units: Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.

1.5 AS-BUILT DOCUMENTATION

SPEC WRITER NOTE: Coordinate O&M Manual requirements with Section 01 00 00, GENERAL REQUIREMENTS. O&M manuals shall be submitted for content review as part of the close-out documents.

- A. Submit manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.
- B. Submit operation and maintenance data updated to include submittal review comments, VA approved substitutions and construction revisions shall be //in electronic version on CD or DVD// inserted into a three-ring binder. All aspects of system operation and maintenance procedures, including applicable piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices shall be included. A List of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.

SPEC WRITER NOTE: Select and edit one of the bracketed options after the paragraph below to indicate the format in which the contractor must provide record drawing files. Select the hand-marked option only when the designer has been separately contracted to provide the record drawings from the contractor's mark-ups. Select the BIM option only when a BIM model will be generated, which is typically only performed by the designer on some Design-Bid-Build projects or by the contractor on some Design-Build projects.

- C. The installing contractor shall maintain as-built drawings of each completed phase for verification; and, shall provide the complete set at the time of final systems certification testing. Should the installing contractor engage the testing company to provide as-built or any portion thereof, it shall not be deemed a conflict of interest or breach of the 'third party testing company' requirement. Provide record drawings as follows:
1. //Red-lined, hand-marked drawings are to be provided, with one paper copy and a scanned PDF version of the hand-marked drawings provided on CD or DVD.//
 2. //As-built drawings are to be provided, with a copy of them on AutoCAD version // // provided on CD or DVD. The CAD drawings shall use multiple line layers with a separate individual layer for each system.//
 3. //As-built drawings are to be provided, with a copy of them in three-dimensional Building Information Modeling (BIM) software version // // provided on CD or DVD.//
- D. The as-built drawings shall indicate the location and type of all lockout/tagout points for all energy sources for all equipment and pumps to include breaker location and numbers, valve tag numbers, etc. Coordinate lockout/tagout procedures and practices with local VA requirements.
- E. Certification documentation shall be provided to COR 21 working days prior to submitting the request for final inspection. The documentation shall include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and provide documentation/certification that all results of tests were within limits specified. Test results shall contain written sequence of test procedure with written test results

annotated at each step along with the expected outcome or setpoint. The results shall include all readings, including but not limited to data on device (make, model and performance characteristics), normal pressures, switch ranges, trip points, amp readings, and calibration data to include equipment serial numbers or individual identifications, etc.

PART 2 - PRODUCTS

SPEC WRITER NOTE: With electric powered pumps, evaluate the application for possible cavitation issues. Meet the manufacturer's NPSHR requirements and if necessary sub-cool the condensate and downrate the pump. If cavitation is still likely, consider using pressure powered pumps instead.

2.1 CONDENSATE PUMP, PAD-MOUNTED

- A. General: Factory assembled unit consisting of vented receiver tank, motor-driven pumps, interconnecting piping and wiring, motor controls (including starters, if necessary) and accessories, designed to receive, store, and pump steam condensate.
- B. Receiver Tank: Cast iron with threaded openings for connection of piping and accessories and facilities for mounting float switches. Receivers for simplex pumps shall include all facilities for future mounting of additional pump and controls.
- C. Furnish seals for condensate pump with a minimum temperature rating of 121 degrees C (250 degrees F).
- D. Centrifugal Pumps: Bronze fitted with mechanical shaft seals.
 - 1. Designed to allow removal of rotating elements without disturbing connecting piping or pump casing mounting.
 - 2. Shafts: Stainless steel, Type 416 or alloy steel with bronze shaft sleeves.
 - 3. Bearings: Regreaseable ball or roller type.
 - 4. Casing wearing rings: Bronze.
- E. Motors: Refer to Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION EQUIPMENT.
- F. Pump Operation:
 - 1. Float Switches: NEMA 4, mounted on receiver tank, to start and stop pumps in response to changes in the water level in the receiver and adjustable to permit the controlled water levels to be changed.

Floats and connecting rods shall be copper, bronze or stainless steel.

2. Alternator: Provide for duplex units to automatically start the second pump when the first pump fails in keeping the receiver water level from rising and to alternate the order of starting the pumps to equalize wear. For units 0.25 kW (1/3 hp) and smaller, the alternator may be the mechanical type for use in lieu of float switches.
- G. Control Cabinet for 3 Phase (0.37 kW (1/2 hp) and larger) Units: NEMA 4, UL approved, factory wired, enclosing all controls, with indicating lights, manual switches and resets mounted on the outside of the panel. Attach cabinet to the pump set with rigid steel framework, unless remote mounting is noted on the pump schedule.
1. Motor starters: Magnetic contact types with circuit breakers or combination fusible disconnect switches. Provide low voltage control circuits (120-volt maximum) and HOA switches for each pump.
 2. Indicating lights for each pump: Green to show that power is on, red to show that the pump is running.
- H. Electric Wiring: Suitable for 94 degrees C (200 degrees F) service; enclosed in liquid-tight flexible metal conduit where located outside of control cabinet.
- I. Receiver Accessories:
1. Thermometer: 38 to 216 degrees C (100 to 420 degrees F), mounted below minimum water level.
 2. Water level gauge glass: Brass with gauge cocks which automatically stop the flow of water when the glass is broken. Provide drain on the lower gauge cock and protection rods for the glass.

2.2 CONDENSATE PUMP, SUMP TYPE

- A. General: Factory assembled unit consisting of motor-driven pump(s) mounted on a horizontal cover plate bolted to a vented sump-type receiver, interconnecting wiring and piping, motor controls and accessories, designed to receive, store, and pump steam condensate.
- B. Receiver Tank: Vertical, cylindrical, cast iron sides and bottom, designed for service underground or below the floor. Inlet connection shall be located nine inches below the cover plate. Provide floor mounting gasket.
- C. Receiver Cover Plate: Heavy gauge steel designed to support weight of pumps, motors, and accessories and support foot traffic with no

- deflection. Provide for mounting of pumps, motor and accessories by bolting to the cover. Provide threaded openings for piping connections and a bolted inspection plate for viewing interior of receiver. All bolted connections to cover plate, and between cover plate and receiver, shall be gasketed so that no vapor will escape into the room.
- D. Furnish seals for condensate pump with a minimum temperature rating of 121 degrees C (250 degrees F).
- E. Pumps: Centrifugal type, vertical extended shaft, bronze fitted, flexible-coupled, designed for submerged operation.
1. Shaft: Stainless steel, Type 416.
 2. Shaft bearings: Bronze, water lubricated.
 3. Shaft seal at cover plate: Packed type with bronze packing gland.
 4. Thrust bearings: Regreaseable ball type located above the cover plate.
 5. Discharge pipes: Terminate above the cover plate.
 6. Pump-motor mounting: Bolted to brackets bolted to the cover plate.
Removal of one pump shall not affect operation of the second pump.
- F. Motors: Refer to Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION EQUIPMENT.
- G. Pump Operation:
1. Float Switches: NEMA 1, mounted on receiver tank, to start and stop pumps in response to changes in the water level in the receiver, and adjustable to permit the controlled water levels to be changed. Floats and connecting rods shall be copper, bronze or stainless steel.
 2. Alternator: Provide for duplex units to automatically start the second pump when the first pump fails in keeping the receiver water level from rising and to alternate the order of starting the pumps to equalize wear. For units 0.25 kW (1/3 hp) and smaller, the alternator may be the mechanical type for use in lieu of float switches.
- H. Electric Wiring: Suitable for 94 degrees C (200 degrees F) service; enclosed in liquid-tight flexible metal conduit where located outside of control cabinet.

SPEC WRITER NOTE: Vacuum return systems are mostly not used for the VA Facilities. Use this section only where renovation or replacement of the pumps is required in the existing facilities.

2.3 VACUUM PUMP, HEATING

- A. General: Factory assembled unit consisting of water storage and air separating facilities, duplex water pumps, duplex air pumps, motors, controls and accessories, designed to receive, store, and pump the steam condensate from a vacuum return system. The unit shall also produce the required vacuum.
- B. Receiver Tank: Cast iron or galvanized steel and shall include water storage and air separation chambers.
- C. Water and Air Pumps: Centrifugal type, bronze fitted, with mechanical shaft seals.
 - 1. Performance: Rating based on condensate at 71 degrees c (160 degrees F) and 20 kPa (6 inches of mercury vacuum). Perform test in accordance with factory instructions.
 - 2. Design pump to allow removal of rotating elements without disturbing connecting piping or pump casing mounting.
 - 3. Shafts: Stainless steel.
 - 4. Bearings: Grease-lubricated ball or roller type.
 - 5. Casing Wear Rings: Bronze.
- D. Motors: Refer to Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION EQUIPMENT.
- E. Air and Water Pump Operation:
 - 1. Adjustable float switches: Mounted on receiver tank, to start and stop water pumps in response to changes in the water level in the receiver. Floats and connecting rods shall be copper, stainless steel, or bronze.
 - 2. Adjustable vacuum switches: Mounted on receiver tank, to start and stop air pumps in response to vacuum requirements of the heating system.
 - 3. Alternators of water pumps and for air pumps: To alternate the sequence of starting the pumps and to automatically start the second air or water pump when the first pump fails to meet the air or water demand.
- F. Control Cabinet for 3 Phase (0.37 kW (1/2 hp) and Larger) Units: NEMA 4, UL approved, factory wired, enclosing all controls, with indicating lights, manual switches and resets mounted on the outside of the panel. Attach cabinet to the pump set with rigid steel framework, unless remote mounting is noted on the pump schedule.

1. Motor starters: Magnetic contactor types with circuit breakers or combination fusible disconnect switches. Provide low voltage control circuits (120-volt maximum) and HOA switches for each pump.
 2. Indicating lights for each pump: Red to show that the pump is running, green to show pump is off.
- G. Electric Wiring: Suitable for 94 degrees C (200 degrees F) service; enclosed in liquid tight flexible metal conduit where located outside of control cabinet.
- H. Accessories Required:
1. Thermometer: Mounted on receiver below minimum water level.
 2. Water level gauge: Mounted on each compartment of receiver. Provide gauge cocks which automatically stop the flow of water when the glass is broken. Provide gauge glass protection rods and a drain on the lower gauge cock.
 3. Compound gauge. Refer to Section 23 22 13, STEAM AND CONDENSATE HEATING PIPING.
 4. Temperature limit switch: To automatically admit cooling water to the air separation chamber when air separation water temperature exceeds the manufacturer's recommended limit.
 5. Automatic water make-up control to the air separation changes: Float switch and solenoid valve. Provide manual by-pass valve.
 6. Muffler: When required to prevent the air vent sound from exceeding 90 db(A) at a distance of 1.8 m (6 feet) from the unit.
 7. Vacuum breaker: Minimum adjustment range 20 to 50 kPa (6 to 15 inches of mercury), to protect the pump unit from excessive vacuum.

SPEC WRITER NOTE: Pressure powered condensate pumps shall be considered if pressure greater than 480 kPa (70 psig) is available.

2.4 PRESSURE POWERED CONDENSATE PUMP

- A. Pressure-Powered Pump Packages:
1. Pump packages shall be furnished and installed as a packaged assembly of the types, sizes, capacities, and characteristics as shown on the drawings. Pump package shall be rated for not less than 185 degrees C (365 degrees F), maximum condensate temperatures.
 2. Pump package(s) shall come completely piped and mounted on a steel skid including (1) receiver/reservoir, two positive displacement pressure-powered pumps as scheduled, interconnecting piping and valves, and all accessories as hereafter specified below:

- a. The receiver shall be of a steel elevated design, warranted for 1 year against defects in material and workmanship. Receiver shall be 150 psig ASME labeled and coded. Receiver shall be sized for the required condensate storage volume and flash steam capacity. Receiver shall be horizontally mounted and have openings of the appropriate size and number including: (2) inlets, (1) vent opening, (1) NPT drain with pipe plug, (1) NPT anode opening with anode, and gauge glass openings with gauge glass set consisting of (2) brass isolation valves and guard rods, and red-line tubular glass. Replaceable magnesium anode, which retards the corrosive action of most waters and adds to the service life of the tanks, shall be furnished with each receiver for corrosion protection.
- b. Pressure-powered pumps shall be non-electric as shown on the drawings. Units shall be constructed of 1034 kPa (150 psig) ASME labeled and coded fabricated steel body, shall be float operated, and contain a condensate inlet baffle. Each unit shall have (1) inlet check valve, (1) outlet check valve, and gauge glass set with isolation valves.
- c. The float operating mechanism shall have all moving components constructed of stainless steel and be of a snap acting design with no external seals or packing. The float mechanism shall contain a reinforced stainless-steel float, (2) 300 series stainless steel open coil design springs, and spring calibration pins.
- d. Pressure-powered pumps shall be of a non-cavitating design capable of operation on systems up to the maximum working pressure of the tank rating using steam, compressed air, or other compatible inert gas as the supply (motive) pressure. Units shall be capable of operating at temperatures up to 185 degrees C (365 degrees F) when pumping from a 'closed' system using a compatible motive gas. Balance and fine tune motive pressure to be 138 kPa (20 psig) higher than the static backpressure.
- e. Package shall include interconnecting piping between receiver/reservoir and the positive displacement pressure-powered pump(s). Interconnecting suction (fill) line shall be provided to each unit and each suction (fill) line shall include a gate valve

for isolation. Pipe material and schedule shall comply with Section 23 22 13, STEAM AND CONDENSATE HEATING PIPING.

- f. Manufacturer shall provide the following for field installation on each pressure-powered pump:
 - 1) Digital Cycle counter
 - 2) Removable insulation jacket
 - 3) Pressure gauge
 - 4) Drain piping
 - g. Provide the following components for each pump:
 - 1) Motive pressure reducing valve
 - 2) Safety relief valve(s)
 - 3) Motive pressure inlet strainer
 - 4) Pressure gauge with pigtail, as required
 - 5) Motive pressure drip trap(s)
 - 6) Motive pressure line check valve(s)
 - 7) Motive pressure shut-off valve
 - 3. The package shall be factory tested as a complete unit using steam as the motive pressure. The pump manufacturer shall furnish appropriate assembly and parts drawings, and installation and operation manuals. The package shall be shipped completely assembled, or with connection match marks if package must be shipped as sub-assemblies.
- B. Removable Insulation Jacket:
- 1. The insulation jacket should be of sewn construction with Velcro fasteners and have openings for inlet, outlet, drain, and gauge glass.
 - 2. Materials:
 - a. Liner and jacket shall be silicone impregnated heavy duty glass fiber rated for a maximum temperature of 260 degrees C (500 degrees F).
 - b. Insulation shall be 25 mm (1 inch) minimum thickness, Type E needled glass fiber mat rated for a maximum temperature of 650 degrees C (1200 F).
 - c. Jacket shall be sewn with Nomex thread with a UV inhibitor.

PART 3 - EXECUTION**3.1 INSTALLATION**

- A. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no additional cost or time to the Government.
- B. Follow manufacturer's written instructions for pump mounting and startup. Access/Service space around pumps shall not be less than minimum space recommended by pumps manufacturer.
- C. Sequence of installation for base-mounted pumps:
 - 1. Level and shim the unit base and grout to the concrete pad.
 - 2. Shim the driver and realign the pump and driver. Correct axial, angular or parallel misalignment of the shafts.
 - 3. Connect properly aligned and independently supported piping.
 - 4. Recheck alignment.
- D. Pad-mounted Condensate Pump //or Vacuum Pump//: Level, shim, bolt, and grout the unit base onto the concrete pad.
- E. Sump Type Condensate Pump: Apply two coats of asphalt or bituminous compound on the exterior of the receiver tank, and mount level and flush in the floor with waterproofing gaskets and grouting to prevent ground water from entering the building from around the receiver.
- F. Coordinate location of thermometer and pressure gauges as per Section 23 22 13, STEAM AND CONDENSATE HEATING PIPING.

3.2 STARTUP AND TESTING

- A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.
- B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.
- C. //The Commissioning Agent will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with COR and Commissioning Agent. Provide a minimum notice of 10 working days prior to startup and testing.//
- D. Verify that the piping system has been flushed, cleaned and filled.
- E. Lubricate pumps before startup.

- F. Prime the pump, vent all air from the casing and verify that the rotation is correct. To avoid damage to mechanical seals, never start or run the pump in dry condition.
- G. Verify that correct size heaters-motor over-load devices are installed for each pump controller unit.
- H. Field modifications to the bearings and or impeller (including trimming) are prohibited. If the pump does not meet the specified vibration tolerance send the pump back to the manufacturer for a replacement pump. All modifications to the pump shall be performed at the factory.

3.3 //COMMISSIONING

- A. Provide commissioning documentation in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.
- B. Components provided under this section of the specification will be tested as part of a larger system.//

3.4 DEMONSTRATION AND TRAINING

- A. Provide services of manufacturer's technical representative for //4//
// // hour//s// to instruct each VA personnel responsible in operation and maintenance of the system.
- B. //Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.//

- - - E N D - - -