**SECTION 22670 – PROCESS COOLING WATER SYSTEM**

PART 1 ‑ GENERAL

1.01 SUMMARY

1. This Section includes hydronic boiler packaged system construction, components, required trim, controls, and accessories necessary for hydronic space heating.

1.02 REFERENCES

1. Comply with applicable Codes/Standards of ANSI, ASME, AGA, NEC, UL, FM, and the State.
2. Section 15185 – Hydronic Pumps and Hydronic Specialties
3. Local air quality district emission requirements.

1.03 QUALITY ASSURANCE

1. Provide factory tests to check construction integrity and control function of the complete system.
2. Boiler shall be condensing type certified to operate at minimum efficiency of 95 percent at 100 percent of firing rate.
3. Installed materials not meeting specification requirements of the Contract Documents will be subject to removal and replacement

1.04 SUBMITTALS

1. Comply with provisions of Section 01 30 00 - Submittals.
2. Manufacturer's descriptive literature, operating instructions, maintenance and repair data.
3. Manufacturer's installation instructions.
4. Detail Drawings showing dimensions and electrical diagrams.
5. Submit boiler start up, testing, and adjusting certificate.

PART 2 ‑ PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

1. Contractor to furnish and install a pre-assembled, pre-piped, hydronic heating equipment package as manufactured by FlowTherm Systems or approved equal. Alternate package system manufacturers must be able to demonstrate a successful history of manufacturing similar systems for a minimum of 10 years.

2.02 MOTORS AND CONTROLS

 A. Motors: Provided with equipment. Refer to Section 26XXXX ‑ ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT.

 B. Motors Starters: Provided with equipment. Refer to Section 26XXXX - ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT.

2.03 EQUIPMENT REQUIREMENTS

 A. General:

1. The packaged system shall include, at a minimum, the following components:
	1. *One (1) or Two (2)* plate and frame heat exchanger
	2. Two (2) process water pumps
	3. Two (2) bag type process water filters
	4. Expansion tank
	5. Process loop air separator with automatic air vent
	6. Thermometers, gauges, isolation valves and inter-connecting piping.
2. All components shall be securely welded or bolted to a structural steel frame covered in ¼” steel plate. The entire assembled unit shall be coated in Tnemec N69 polyamidoamine epoxy. It is acceptable to provide the packaged system as multiple skids which are field installed directly adjacent to one another with factory-supplied interconnecting piping and electrical.
3. The package(s) shall be designed to supply and contain provisions for monitoring and controlling the delivery of filtered cooling water at the specified flow, pressure and temperature.
4. The package will have the following connection points:
	* + Power
		+ Cold Water Make-up
		+ Process water supply
		+ Process water return
		+ Cooling water supply
		+ Cooling water return
5. The package(s) shall be UL Listed according to Standard 508A for control panels and UL Standard 778 for Pumping Systems.
6. Performance: Refer to Schedule on Drawings.
	1. PROCESS COOLING PACKAGE CONSTRUCTION
7. HEAT EXCHANGER(S) – Plate and Frame
	1. Design
		1. To reduce installation and maintenance cost, units should be designed as single pass units unless thermal and hydraulic conditions require multi-pass arrangement.
		2. For single pass units all connections should be located on the fixed head, frame plate, allowing the movable head, pressure plate, to slide back and plates added, removed, or replaced from the plate pack without disturbing the connections or associated piping.
		3. The design should allow for the removal of interior plates without the removal of the plates.
		4. The unit shall be provided with an *aluminum or stainless steel* OSHA splash shield.
		5. The unit shall be designed, hydro-tested, and U-1 stamped in accordance with ASME Section VIII Division 1.
	2. Frame
		1. The frame plate and pressure plate should be carbon steel SA 516 grade 70.
		2. The frame and pressure plate shall be of sufficient thickness to meet the ASME design pressure. Stiffeners or support brackets are not allowed.
		3. Carbon steel frame components shall be painted with gray epoxy paint.
		4. Units with ports 2” or less shall have 316 stainless steel male NPT connections.
		5. Units with 3-inch or greater connections shall be unlined or alloy lined studded ports to mate with raised face or flat faced ANSI flanges. Rubber liners are not allowed.
		6. Units with connections greater than 50mm (2-inch) require that the thermal plates be supported by the carry bar, top bar. The guide bar, bottom bar, shall only help properly align the plates.
		7. The pressure plate shall be supported by a roller assembly from the carry bar for units with 65mm (2 1⁄2-inch) or greater port sizes.
		8. The carry and guide bar plate contact surfaces shall be corrosion resistant.
		9. The design for units with 2-inch connections or smaller allow the plates be supported by the guide bar, bottom bar, and the carry bar, top bar, shall help properly align the plates. Carry and guide bars are to be steel with a zinc chromate coating.
	3. Tightening Bolts
		1. Tightening bolts shall be zinc plated carbon steel SA193 B7.
		2. The tightening bolt assemblies shall include captive working nuts at the pressure plate, rear head, such that the unit can be opened and closed with one wrench from the front of the unit.
	4. Plates
		1. Plates shall be pressed in a one-step stamping process.
		2. Material shall be 316L stainless steel of thickness greater than or equal to .5mm.
		3. Plates shall use an integral rolled edge hanging system to provide a rigid hanger device between the plate and carry bar and guide bar. Welded on hanging brackets or stiffeners are not acceptable.
		4. The plate pack shall use a positive plate to plate alignment system to ensure proper plate to gasket seals throughout the plate pack. The positive alignment system shall either be a gasket lug which fits within a plate recess on the proceeding plate (tongue in groove) to align successive plates or an extended rolled edge hanger which nests successive plates through direct contact around the entire plate hanger. Plate designs, which only offer alignment through contact with the carry and guide bar, are unacceptable.
		5. Plates shall be permanently marked to indicate plate material and thickness.
	5. Gaskets
		1. All gaskets except the gasket on the first plate shall be identical.
		2. The gaskets shall be a one-piece construction with a double gasket barrier at the port region. The area isolated by the double gasket shall be vented to the atmosphere, so that a gasket failure is detected by leakage to the exterior prior to any possible cross contamination.
		3. Gasket attachment methods, which break during gasket removal or plate maintenance thus destroying the gasket, are not allowed.
		4. Care should be taken in the selection of gasket materials to insure compatibility with the fluids and operating temperatures.
	6. Thermal/Hydraulic Design, Certification and Testing
		1. The manufacturer shall provide written guarantee to the accuracy of the heat exchanger thermal design.
		2. The manufacturer shall be certified with the Air-Conditioning and Refrigeration Institute’s Liquid to Liquid Heat Exchanger Certification program ARI Standard 400 for the Model being supplied.
		3. Should the Heat Exchanger not perform to the specified conditions as defined in the ARI Standard 400, the manufacturer is responsible to replace or repair the exchanger to achieve the stated performance.
		4. If the manufacturer is not certified with the Air-Conditioning and Refrigeration Institute’s Liquid to Liquid Heat Exchanger certification program ARI Standard 400, a witnessed factory performance test must be completed per the testing specification of ARI 400.
8. PROCESS LOOP PUMP(S)
	1. Process loop pumps shall be multistage centrifugal pump units, Model e-SV as manufactured by Goulds Water Technology, or equal. All pumps shall be from one manufacturer provided complete including electric motor drive and mechanical seal.
	2. Pump Construction
9. The pump casing shall be of deep drawn, laser welded AISI 316L stainless steel (optional cast iron) and shall be capable of withstanding maximum working pressures of 360 psi. Number based on pump staging and flange selection.
10. Piping connections shall be in-line (optional top/bottom) and shall be compatible with ANSI raised face flanges.
11. Wear rings composed of PPS shall be provided within each stage. Wear rings must be self-centering and easily replaceable.
12. Impellers shall be of enclosed design and constructed of AISI 316L stainless steel. Impellers shall provide internal thrust balance in each stage.
13. Each stage shall have a bowl with attached diffuser and be constructed of AISI 316L stainless steel.
14. The seal housing shall be of concave design and shall hold the seal faces below the topmost part of the pump casing.
15. The pump shaft seal shall be Silicon Carbide Silicon Carbide EPR.
16. The pump shall have shaft sleeves made of Tungsten Carbide and ceramic bearings. Shaft height shall be set with a standard spacer.
	1. Electric Motor

The pump drive motor shall be NEMA standard design TC frame suitable for vertical mounting and close coupled to the pump unit. Motors shall be of standard manufacturers catalog design and must not use special bearings as a thrust handling device. The motor rating shall be per equipment schedule.

* 1. Testing

Each pump shall be hydrostatically tested by the manufacturer in accordance with Hydraulic Institute Standards at a minimum of 350 PSI.

1. PROCESS LOOP AIR SEPARATOR
	1. Air separator shall be an inline type fabricated from *304L or 316L* stainless steel.
	2. An automatic air vent shall be provided
2. CONTROL VALVES
	1. Valves on the process loop shall have only 316L stainless steel, chrome, Teflon and/or EPDM as wetted components. Actuators to be 24VAC powered with 0-10 VDC control.
	2. Valves on a condenser water loop may be constructed of cast/ductile/malleable iron and be of butterfly, globe or ball type. Actuators to be 24VAC powered with 0-10 VDC control.
3. EXPANSION TANK
	1. Expansion tank shall be a steel expansion tank with heavy-duty butyl bladder. The tank shall have stainless steel NPT system connections and a 0.302”-32 charging Schrader valve to facilitate the on-site charging of the tank to meet system requirements. The tank must be constructed in accordance with most recent addendum of Section VIII Division 1 of the ASME Boiler and Pressure Vessel Code.
	2. Expansion tank to be provided with pressure gauge, drain valve, and isolation valve.
4. CHEMICAL POT FEEDER
	1. A chemical pot feeder with isolation and bypass valves shall be provided. The pot feeder shall have a maximum operating temperature of 200 o F at 200 PSI. The pot feeder shall have ¾” NPT connections and shall have a capacity of 2 gallons.
	2. Pot feeder shall be *304L or 316L* stainless steel construction.
5. PROCESS WATER FILTRATION
	1. Filter housing(s) shall be constructed of 316L stainless steel and accept bag type filter elements.
	2. Filter housing(s) shall be rated for 150 psig working pressure and shall bear an ASME Section VIII ‘U’ stamp
	3. Filtration micron rating per equipment schedule.
6. ISOLATION VALVES
	1. Isolation valves shall be provided to service all major equipment and components on the process cooling water package.
	2. Valves under 2” inclusive shall be ball valves
		1. Valve shall have 304L or 316L cast body
	3. Valves over 2” shall be butterfly valves
		1. All butterfly valves shall have bubble tight shut off at full rated pressure in both flow directions.
		2. Valve shall be suitable for end of line service at full pressure rating
		3. Overmolded seat shall provide sealing surface for flanges
		4. Valve shall be of cast/ductile iron body construction with EPDM seat and 316L stainless steel disk being the only wetted parts.
7. TEMPERATURE CONTROL PANEL WITH LOCAL CONTROL

A Temperature Control Panel will provide a single point power connection for all packaged equipment, PLC system control, variable frequency drives, and BACnet communication. The panel shall include:

* Single point power connection with non-fused main power disconnect
* NEMA 1 enclosure
* PLC controller with 6” color touch screen HMI
* VFDs with door-mounted keypads for process cooling system pumps
* Through-the-door power disconnects for process cooling system pumps
* Local-Off-Remote system selector switch to allow for local “stand alone” operation or remote system enable/disable.
* BACnet field server to provide BMS interface to all equipment
* System differential pressure transmitter (shipped loose for field installation by others)
1. Process cooling package shall be hydrostatically tested to 150 psig.
2. Functionality Test: Perform a factory functional test of all system electrical components and skid wiring prior to shipment.

PART 3 ‑ EXECUTION

3.01 FIELD ASSEMBLY REQUIREMENTS

1. Place and mount skid on a level concrete equipment pad
2. Make utility and system connections as described in item 2.04.I of this section.

3.02 INSTALLATION

1. Install process cooling package on concrete pad as instructed by manufacturer.
2. Provide services of manufacturer's representative to supervise rigging, hoisting, and installation of package.
3. Coordinate electrical and control work.
4. Install ship loose items, such as sensors, sight glasses, safety valves, and gauges.
5. Pipe safety valves to floor drain.

3.03 START UP

1. Provide services of manufacturer's representative to inspect package after installation is complete and submit report prior to start up, verifying installation is in accordance with specifications and manufacturer's recommendations.
	1. The package manufacturer shall provide the services of a trained technician to assist in starting up, adjustment and operation of pumps and all other equipment furnished by the manufacturer. In addition, the technician shall perform requisite field tests and instruct the Owner's operating personnel in the proper operation and maintenance of the unit.

END OF SECTION