

THERMA-FEED

PRE-DEAERATION BOILER FEED SYSTEM

INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

DESCRIPTION OF EQUIPMENT

Refer to Specification Sheet 3100 for general description of materials furnished. Specific equipment furnished for this installation will be shown on the System Layout Drawing and Submittal Sheet included in the Instruction Manual.

DESCRIPTION OF OPERATION:

The 3 basic requirements to effectively remove excess oxygen is that:

1. Water must be brought to the boiling point corresponding to the pressure at which it is held in storage, and
2. Through physical shake out of entrained gas by injecting steam into the water, and
3. To allow free venting to atmosphere whereby quick removal of liberated gases is accomplished which will prevent recontamination.

The first requirement of pre-deaeration occurs when the water in the storage tank is heated to 208 deg. F. The water is heated with live steam injected below the waterline to maintain the pre-deaeration point and provide proper scrubbing action to physically separate air molecules from the water. Condensate in storage should be maintained at pre-deaeration point to prevent re-absorption of gases by setting the temperature control to maintain 205 deg. F to 208 deg. F water temperature in the storage tank.

The second requirement of removing liberated gases quickly is accomplished in fully vented receiver which provides unobstructed release of gases. Because oxygen and CO₂ are heavier than steam, some steam should escape to the atmosphere to assure complete removal of gases.

INSTALLATION, PIPING AND WIRING

RECEIVING - The system should be carefully inspected upon arrival to make certain no damage or loss occurred during shipment. Any damage or loss should be immediately reported to the transportation company making final delivery; damage is the exclusive liability of the carrier.

Location of Unit: System should be located to allow for easy access to all working parts for maintenance and adjustment. In addition, adequate clearance should be allowed for removal of the diffuser tube(s)

Provide adequate headroom for vent piping and level control(s) removal. Motors, panel, controls and automatic equipment must be protected from excessive heat and moisture and

abnormal atmospheric conditions. If ambient temperature exceeds 105 degrees F., insulate heat sources or provide ventilation.

Storage: If unit will not be installed within a reasonable period of time after delivery, it should be stored indoors, if possible, and adequately protected from accidental damage, abuse, and weather.

Receiver: Interior has been Epoxy-Glass Lined. Refer to tank warranty from before attempting to weld or flame cut.

Returns: High pressure-direct (above 212 deg. F.) – connect to the high pressure return tubes (furnished only if specified by contractor) below the waterline of the receiver. Install with check valve and “Y” strainer with blow-down valve as close to receiver as possible.

Low pressure – gravity or pumped (below 212 deg. F.) – connect to low pressure returns opening on top of the receiver. Install with gate valve and “Y” strainer.

Make-Up Supply: Run full size water supply pipe to make-up inlet connection shown on job drawing. Install manual bypass valve and piping (when not furnished by factory).

Vent: Install full size open vent pipe to atmosphere, (size per job drawing - wrought iron or X-HVY pipe recommended). Vent line should be run vertically or take most direct route to atmosphere. Excessively long horizontal runs with numerous bends, fittings or “traps” will impair venting efficiency and prevent proper operation.

Overflow and Drain: Units are factory equipped with tank drain gate valve, and internal overflow trap with external pipe (unless otherwise specified). Connect full size drain to sewer per job drawing.

Steam Supply (Optional): Select proper size pipe for required steam flow, generally at least one size larger than the control valve. Adequately sized steam piping will help assure that the minimum supply pressure at the regulator inlet will be maintained. (Refer to submittal sheet or nameplate for minimum supply pressure required).

Inlet “Y” strainer is factory furnished. Install strainer blow-off valve and pipe to drain. Install over-size inlet valve (when not factory furnished) in steam supply line ahead of “Y” strainer. Use eccentric reducer to install shut-off valve so as to avoid “water pockets”.

Steam piping and fittings installed should be rated for maximum steam supply pressure.

Boiler Feed Pumps: Factory assembled units include suction lines consisting of gate valve, compression coupling, and necessary fittings. Install strainer blowdown valve and pipe to sewer if strainers are installed.

Pump discharge piping, when furnished by factory, will be as shown on System Layout Drawings. Install square head plug cock and connect to boiler(s) as indicated on plans and spec.

Pump discharge piping furnished in field should include a silent check valve, gate valve, and square head plug cock. Plug cock must be included and set for pump discharge pressure as indicated in submittal data. Pipe sizing should be as indicated on plans. In general, discharge lines are to be one size greater than the pump discharge opening in order to reduce friction losses.

When feed pumps are to be run continuously, operation against a dead-end shut-off condition may exist. In such cases, a bypass orifice, spring loaded relief valve, or differential pressure regulator is required for protection of pump and motor. The relieving device, if factory furnished, should be piped as shown on job drawing.

Level Controls (Optional): Controllers furnished with unit are top mounted probe type devices. Low alarm control is factory set to “make” at a point that provides a minimum of 2” below the tank overflow connection. When optional top mounted displacer type is specified, refer to manufacture’s bulletin for specific setting and adjustment data.

Standard makeup control consist of a solenoid valve and probe level device. On small units, the controller is a mechanical feeder, which is factory mounted and piped. On specific units (optional), a pneumatic control system is furnished. Displacer set point should be adjusted to maintain water level at midpoint of tank. Proportional band should be set at approximately 30%. Refer to manufacture’s bulletin for specific setting and adjustment instruction.

NOTE: Displacer type level controls are factory set and installed, then removed and package separately to prevent damage in shipment. They must re-installed in field by installing contractor.

AIR SUPPLY: Factory packaged units equipped with pneumatic controls are pre-piped and include an air PRV and filter. Connect clean air supply air PRV inlet and install with shutoff cock for ease of maintenance. Refer to job drawing minimum supply pressure required.

Insulation (Optional): For optimum thermal efficiency, tanks are factory insulated with 2” fiberglass and clad with a metal jacket if so specified by contractor or owner. If not factory insulated, tanks should be insulated in the field. Steam supply and related piping should be insulated in field as required by specifications.

Chemical Treatment: Do not introduce chemical treatment directly into receiver. All chemical treatment should be introduced to the system on discharge side of boiler feed pumps in order to maintain tank and pump warranty.

Electrical Wiring Controls: Connect power leads in accordance with wiring diagram furnished with unit. Connect boiler level, alarm, makeup, etc. controls to terminal strip as indicated on wiring diagram.

THERMA-FEED

PUTTING THE UNIT INTO SERVICE

START UP CHECK POINTS

Package systems have been factory tested prior to shipment. It is recommended that all piping and wiring connections be checked on arrival at the jobsite, as handling during transit may have caused loosening.

Prior to start-up of your unit, all piping and wiring diagrams furnished should be carefully reviewed. All connections should be made as indicated in installation, operating and maintenance instructions. Pages 1 through 5, drawings furnished with unit, and applicable local codes.

BEFORE STARTING YOUR UNIT, CHECK THE FOLLOWING:

1. Check tank interior to be sure there are no loose stones, trash, etc. dropped in the tank during construction or by children, etc.
2. Power supply connected to panel. (Disconnect(s) are "OFF").
3. Power supply and motor voltage is compatible.
4. Control transformer is wired for proper primary voltage.
5. Motor wiring in motor terminal bow has correct leads wired to panel starters.
6. Pump "Start" pressure switch, if furnished, wired to correct panel terminal points.
7. Tank level alarm controls wired to proper panel terminal points. (Depress alarm silence button if low water alarm is sounding.)
8. Make-up valve and controller (if electric) wired to proper panel terminal points.
9. Transformer secondary is grounded (if required by local code).
10. Boiler level controls properly wire to panel terminal strip. (**NOTE:** Boiler controller should have only one source of control voltage-either from deaerator panel or boiler circuit – **NEVER BOTH.**)
11. Manhole bolts all in place and tight.
12. Pressure and temperature gauges are properly located and have correct dial ranges.
13. Open "T" cocks on all pressure gauges.
14. Are di-electric fittings installed in all non-ferrous piping to units?
15. Check pump rotation manually to be sure there is no binding.
16. Check pump motor alignment. If mis-alignment has occurred during transit, jobsite re-alignment is necessary. Refer to pump instructions bulletin for procedure.
17. Pump casing drain plugs are in place.
18. Pump suction and discharge lines are open.
19. Check valves are properly installed in direction of flow.
20. Steam valve control piloting and thermostat properly installed.

21. Install level control devices if shipped separately. Check level control operating mechanisms and remove shipping devices so that switches operate freely.
22. Install water gauge glass devices if shipped separately.
23. Is pump discharge piping adequately supported to eliminate strain on casing?
24. Has system been installed level? Shim, if needed.
25. Air supply to Pressure Relief Valve Filter, if required, has been installed with "T" cock.
26. All strainer baskets installed and blowdown pipe connected.

START UP PROCEDURE:

After start-up check points have been completed and necessary adjustment made, proceed to put the unit into service.

1. Closed the following hand vales:
 - -Tank drains.
 - -Make-up (and transfer) by –pass.
 - -Strainer blowdown valves.
 - -Main steam valve.
2. Open hand valves in the following sequence:
 - a. Pump suction and discharge.
 - b. Makeup line valves at inlet and outlet of the automatic valves.
 - c. Water gauge cocks.
 - d. Steam control pilot shut-off cock.
 - e. Air supply cock to PRV-Filter regulator.
2. As air supply cock is opened, adjust air PRV to deliver 20 psig (minimum 25 psig maximum) to Modulating controller. Modulating makeup and transfer valves will open and admit water to the receiver. When water reaches mid-point of the gauge glass, the unit will be primed, and normal water level is attended. Check and adjust modulating controller at this time to maintain a 4-6" proportional band with respect to the tank centerline. (See pneumatic controller instruction manual.) (Tighten all connections in pneumatic and liquid lines if necessary.
3. Close disconnect switch (es) to B.F. and transfer pump motor starters. Pump selector switch (es) should be in "OFF" position, and control power switch should be in "ON" position.
4. Check low water alarm circuit by opening tank drain valve and closing makeup inlet gate valve until level has receded to energize alarm horn. Alarm level setting so that horn sounds when water level is approximately 2" above heater tube. Close drain valve and open make-up inlet valve.

5. If unit is equipped with a high water alarm, open makeup bypass valve until level in tank rises to sound alarm horn. High level alarm should be set so that horn sounds when water level is approximately 2" below overflow connection. Close compartment equalizing line valve.
6. Run each pump manually momentarily and check for proper rotation. If rotation is incorrect, reverse any two of the three leads (three phase motors).
7. After proper pump rotation has been established, continue to run pumps manually. As feed pump is discharging, adjust square head plug cock in discharge line until pressure at pump reaches pump rated pressure shown on submittal curve or stamped on pump. Do not turn pumps at pressures below the lowest design point or at pressures lower than shown on the curve, as motor overload or pump damage may occur. After setting cock, check pump electrical current draw with amp-meter. It should not exceed full load amps as stamped on pump motor. If it does, close square head cock on discharge until amp reading is within nameplate rating.

CAUTION: NEVER RUN PUMPS DRY. SEAL FACES MAY BE DAMAGED IF OPERATED WITH OUT WATER. After plug cocks have been set, turn pump selector switches to "OFF" position. Refer to pump manufacturer's manual for further specific instructions.

8. Gradually open gate valve in the main steam supply line to heater tube. Be certain that unit is filled with cold water before admitting steam.
9. Adjust automatic steam flow regulator so as to maintain 4 psig steam downstream of the regulator. After water in storage tank heats, adjust temperature controller to maintain 205 deg. F. to 208 deg. F. water for sea level installations.
10. Set Selector switches on control panel at desired operating sequence. Refer to electrical schematic furnished with system.

MAINTENANCE – RECOMMENDED SCHEDULE

DAILY-

1. Keep deaerator area clean and free of debris and clutter.
2. Inspect deaerator, valves and piping for leaks.
3. Check pumps, motors and other miscellaneous equipment for abnormal conditions.
4. Monitor the sequence of operations to verify that the deaerator is operating in accordance to boiler sequence.
5. Check pressure, temperature and water level conditions.

WEEKLY-

1. Blow-down float chamber, strainer and equalizing lines. When water color is dark brown or black flush pump drain also.
2. Check incoming make-up, steam and condensate return inlet strainers for sediment build-up (blow-down).

MONTHLY-

1. Verify proper low water cutoff and alarm operation. If possible, the deaerator water level should be lowered to check this control.
2. Raise the safety relief valve lever for a few seconds. This keeps the valve clean and free of sediment and scale.
3. Test stand-by operation sequence (if any), and check magnesium anode for leakage (replace if necessary).

EVERYSIX MONTHS-

1. Remove operating mechanism from any float type or external cage type controller and plugs from crosses in equalizing piping. Clean thoroughly and reassemble.
2. Check pump performance curve and amp draw, an abnormal reading could mean dirt or buildup on impellers, or clogged suction and discharge lines. Clean required.

EVERY YEAR-

1. To clean deaerator interior thoroughly, remove handholes, manhole and flush sediment from tank wall, inspect heated/scrubber surface for scale or corrosion.
2. Inspect steam regulator and pilots. Check for dirty plugged air and control tubing to pilots or valves and controls. Clean as required.
3. Check all internal rods, probes, anodes, surge shields and baffles for corrosion. Replace as soon as possible.

