

## **.005 CC/LITER PRESSUREIZED DEAERATOR**

### **INSTALLATION, OPERATING AND MAINTENANCE INSTRUCTIONS**

#### **DESCRIPTION OF EQUIPMENT**

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**

Basic requirements to effectively remove excess oxygen consist of:

1. Physically shaking out the entrained gas by breaking up the condensate returns and make-up water into mist-like particles, and
2. Bring the water to the boiling point corresponding to the pressure at which it is held storage, and
3. Quickly venting the liberated gases to prevent recontamination.

The first requirement of .005 deaeration occurs when makeup water and condensate returns are atomized through spray nozzles into the pressurized deaerator. This also preheats the water before it passes through an impingement process in the scrubber assembly.

The second requirement is accomplished when the water in the scrubber assembly is released into the storage tank through another process of impingement and steam entrainment causing an increase of the water temperature to 227 deg. F.

The third requirement is accomplished through the vent valve assembly which provides a thermostatic and pressure controlled release of gases. Since oxygen and CO<sub>2</sub> are heavier than steam, a constant purge of steam to the atmosphere is necessary to assure complete removal of gases.

The steam control valve furnished is a sensitive pressure regulator pneumatic adjusted to maintain a minimum of 5 psig of steam in tank. A pressure gauge is furnished on the tank to monitor system performance and aid in adjusting the steam valve.

#### **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 THE UNIT:**

System should be located to allow for easy access to all working parts for maintenance and adjustment.

Motors, panels, controls and automatic equipment must be protected from excessive heat and moisture, and abnormal atmospheric conditions. If ambient temperature exceeds 105 deg. 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:**

If tank interior has been Epoxy-Glass Lined. Refer to tank warranty from before attempting to weld or flame cut.

**CONDENSATE RETURNS:** Connect returns as follows:

|                                                    | <b><u>Single Tank</u></b>                                                                                                       | <b><u>Split Tank</u></b>                                               |
|----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|
| Low Temperature Returns<br>(under 227 Deg. F)      | Pump returns at 15 psi minimum to inlet of spray nozzle manifold                                                                | Pump returns to surge section. Return line pressure must exceed 5 psi. |
| High Temperature Returns<br>(227 Deg. F or higher) | Connect to high temperature return opening on top of receiver. (If over 50%, provide and connect to high pressure return tube.) | Connect to return opening on top of surge section.                     |
| Waste Steam                                        | Connect to a steam inlet tee. Exhaust excess pressure over 15 psi                                                               | Same as single tank                                                    |

### **MAKE-UP SUPPLY:**

Run full size water supply pipe to make-up inlet connection shown on job drawing. In stall manual bypass valve and piping (when not furnished by factory). (Minimum supply pressure should be 40 psi unless specified otherwise)

### **VENT:**

Install open vent pipe to atmosphere, size per job drawing. If long vent line is used, install a tee and drain line to prevent condensate build up. (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 will cause "traps" and will impair venting efficiency. Automatic air vent will not have to be piped.

### **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 floor drain per job drawing. Connect drain line from heat exchanger to sewer. **DO NOT** install shut-off valve between floor drain and overflow connection.

### **STEAM SUPPLY:**

Install proper size pipe, strainer and shut-off valve (unless furnished). Generally steam line should be at least one size larger than the control valve. Adequately sized steam piping will help assure that the desired supply pressure and capacity (1lbs/hr.) at the regular inlet will be maintained. Consult steam flow charts for accurate sizing information. (Refer to design data sheet for minimum supply pressure required.)

In stall eccentric reducer between control valve and strainer to avoid accumulation or "trapping" of condensate.

Steam piping and fittings installed should be rated for maximum steam supply pressure and capacity (1lbs/hr.). Recommended steam velocity for short runs is 5,000 ft. per minute.

### **BOILER FEED PUMPS:**

Factory assembled units include suction lines consisting of gate valve, compression coupling, and necessary fittings.

Pump discharge piping, when furnished by factory, will be as shown on System Layout Drawings. If not furnished, install square head plug cock and connect to boiler(s) as indicated on plans and specifications. Also install a spring loaded check valve, gate valve, and square head balancing valve. The balancing valve must be set for pump discharge pressure as indicated in design data. Pipe sizing should be designed to allow no more than 10 fpm of water

velocity or to be one size greater than the pump discharge opening in order to minimize friction losses and erosion.

If a feed water valve is on the boilers and feed pumps are to run continuously, operation against a dead-end shut-off condition may occur. 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 (unless factory installed) should be piped between pump discharge opening and the check valve back to tank.

### **LEVEL CONTROLS:**

Normally, level controllers and alarm controllers are factory installed and adjusted.

**Inlet Valve:** For single tank systems, an inlet valve may be furnished depending on specifications.

For split tank system an inlet valve is not required providing the transfer pump flow is throttled to prevent overloading the deaerator heating assembly.

An inlet valve functions by controlling all water flowing to the deaerator. (Makeup water is to be admitted to a separate return system.) This valve controls return water flow rate and prevents flooding of the deaerator. Preferably, a pneumatic valve and level controller is furnished. The controller is adjusted to shutoff the inlet valve when the water level is approximately 3" below the overflow pipe. Alternate valves include mechanical float type for small units or float and linkage type for larger units. The inlet valve is factory mounted and adjusted.

Pneumatic valves can be adjusted by turning the controller lever or band spread dials up or down to give the desired operating range.

Mechanical valves can be somewhat adjusted with the mechanical linkage. Large level adjustments may require removing the float box, re-piping and remounting.

Maintenance is important on mechanical valves to prevent the water from leaking.

**Makeup Valve:** Makeup Valves control the flow of fresh softened water from the domestic water supply to the boiler feed system.

For single tank systems, makeup usually connected to the condensate return system.

If makeup is to be connected directly to the single tank deaerator, a pneumatic or float valve is to be used. This valve modulates the flow of new, fresh water and directs it to the inlet manifold.

For split tank systems, makeup water is controlled by the makeup controller, however, the water flows to the surge section.

In each case, makeup water should be added only when the top two-thirds of the deaerator is empty of returned condensate. For pneumatic controllers, the band spread should be set at about 30% and the level set to not over one-third of the water level in the receiver. Refer to manufacturer's instructions for adjustment details.

**Alarm Controllers:** Low water alarms are usually set to active about 6 in. above the bottom of the tank or 2 in. above steam injector tube, if present. When activated, the controller shuts off the pump, lights and indicator light and sounds an alarm. Push the silence button to stop the sound. Resetting is automatic.

High water alarms are set to activate about 2 in. below the heating assembly.

Probe type controls are normally used to sense water level. Level adjustment is made by cutting probes to the desired length. Adjustments are usually not required.

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

**AIR SUPPLY:** An air supply of 30 to 150 psi required to operate the pneumatic controls. Volume requirements are very low – less than 1 cfm for pilot duty.

Connect a clean air supply to the inlet connection on the air filter regulator. The regulator is normally factory set to deliver 20 psi of air to the system. This setting will supply control air to operate the makeup valve. And the level controller if they are pneumatic.

If an air operated steam valve is also furnished, a second filter regulator is included to supply 7 to 10 psi air to the steam valve pilot.

Provide a shut-off cock in the air supply line for ease of maintenance.

Remove dirt, oil and water from the regulator from time to time as required.

### **INSULATION:**

For optimum thermal efficiency, all tanks are recommended to be factory insulated with 2" fiberglass and clad with a metal jacket (unless otherwise specified). If not factory insulated, tanks should be insulated in the field. Heat exchanger, steam supply and related piping should be insulated or marked in field as required by safety specifications.

### **CHEMICAL TREATMENT:**

Boiler water generally requires chemical treatment in addition to the treatment provided by the deaerator. The deaerator removes oxygen from the water. However, chemicals are required to keep the oxygen out of the water and to polish the trace residuals from the water. Chemicals also help to remove scale, prevent corrosion, prevent carryover and protect the condensate return system.

Sellers has no objection to the introduction of these chemicals directly into the deaerator providing the chemical supplier will guarantee they will not damage the deaerator. Introduction of chemicals into the deaerator does provide improved performance of the chemical treatment system.

Chemicals, however, can be damaging to the pumps, especially pump seals. Neither Sellers nor most pump manufactures will honor a warranty claim on pump seals if chemicals are added to the deaerator. Chemical suppliers sometimes will offer such a pump seal warranty. If assurance or guarantees of no damage are not offered, chemicals should be injected downstream of the pumps.

At times, electronic, magnetic or similar devices are used for water treatment. Sellers does not feel these devices provide effective water treatment. If these devices are used, standard water treatment including a water softener, a deaerator and proper chemicals should be used.

**ELECTRICAL WIRING AND CONTROLS:**

Connect power leads in accordance with wiring diagram furnished with unit. Connect boiler level control leads to terminal point as indicated on wiring diagram. No other field connections should be necessary unless panel enclosure has been shipped separately for remote field installation. If so, connect numbered terminals on panel to like numbered terminals on deaerator as indicated in wiring diagram.

## **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. Handling and vibration during transit may have loosened connections, especially pipe unions.

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 instructions, drawing furnished with the unit, and applicable local codes.

#### **BEFORE STARTING YOUR UNIT CHECK THE FOLLOWING:**

1. Power supply connected to panel. (Disconnect(s) are "OFF").
2. Power supply and motor voltage is compatible.
3. Control transformer is wired for proper primary voltage.
4. Pump "start" switch, if furnished, wired to correct panel terminal points. (This switch is not normally used. See wiring diagram.)
5. Make-up valve and controller (if electric) wired to proper panel terminal points. (Normally pre-wire but may have been removed for shipping or installation clearance.)
6. Boiler level control or pump switch is normally powered from deaerator control circuit. Never run power from boiler circuit to deaerator unless so specified and wired. See wiring diagram.
7. All terminal connections are tight.
8. Depress alarm silence button if low water alarm is sounding.
9. Open "T" cocks on all pressure gauges.
10. Are dielectric fittings installed in all non-ferrous piping to units?
11. Pump casing drain plugs are in place. Drain plugs are shipped separate in a bag in the control panel. Note that Grundfos Pumps require a special plug with an O-ring. Do not substitute.
12. Pump suction and discharge lines are open.
13. Check valves are properly installed in direction of flow.
14. Fill tank, after closing all drains; until low water indicator lights turn off and check for leaks
15. Check pump shaft rotation manually (suction line valves to be open). Make sure there is no binding. (Jog manual switch not longer than 2 seconds).
16. Check pump motor alignment on separately couple pumps. If mis-alignment has occurred during transit, jobsite re-alignment is necessary. Refer to pump instructions bulletin for procedure.
17. Is pump discharge piping adequately supported to eliminate strain on casing
18. Steam valve control piloting and thermostat properly installed. Is condensate trap installed ahead of steam valve?

19. Check level control operating mechanisms and remove shipping devices so that switches operate freely. For pneumatic controllers, reinstall the control and tubing.
20. Has system been installed level? Shim, if needed.
21. All strainer screens installed and blowdown pipe connected. A steam supply strainer, if not furnished, is recommended to be installed on supply side of the steam regulator to prevent damage to pilot and regulator.

### **START UP PROCEDURE:**

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

1. Closed the following hand valves:
  - Tank and blowdown drains
  - Make-up by-pass
  - Steam valve bypass (if supplied)
  - Strainer blowdown valves
  - Split tank bypass (split tanks)
2. Open hand valve in the following sequence:
  - a. If contractor installs a valve between overflow trap and floor drain, open valve.
  - b. Pump suction and discharge
  - c. Make-up line valves at inlet and outlet of the automatic valve
  - d. Vent condenser inlet (if any)
  - e. Water gauge cocks
  - f. Steam control pilot shut-off cock
  - g. Air supply cock to PRV filter regulator(s)
  - h. Equalizing line valves on external mounted controllers
3. NOTE: All controls have been factory preset. Minor adjustments may be made if necessary. As air supply line cock is opened, gradually open gate valve in main steam supply line to regulator and adjust air PRV for steam valve pilot to maintain a minimum of 5 psig pressure in tank; adjust second air PRV (if furnished) to deliver 20 psig (minimum) to modulating controller. Modulating makeup valve will open and admit water to the receiver. When water reaches the one-third level of the gauge glass, the makeup valve will close and normal makeup water level is attained. Check and adjust modulating controller at the time to maintain a 4 to 6 inch proportional band. For pneumatic controllers, this means the valve should cycle from closed to full open as the water level drops from 4 to 6 inches from the one-third level.
4. Engage disconnect switch(es) to boiler feed pump motor starters. Pump selector switch(es) should be in "OFF" position and control power switch should be in "ON" position.

5. Check low water alarm circuit by opening tank drain valve and closing makeup inlet gate valve until level has receded to energize alarm horn. Horn should sound when water level is about 6 inches above bottom of tank. Close drain valve and open makeup inlet valve. NOTE: Probe type controls are factory set and cannot be adjusted.
6. Run each pump manually (jog manual for no longer than 1 second) and check proper rotation. If rotation is incorrect, reverse any two of the three leads (three phase motors). Do not allow pump to attain full RPM in reverse direction. (Full speed in reverse direction could cause impellers to spin loose and damage pump internals.) Proper rotation direction is marked on the pump.
7. After proper pump rotation has been established, continue to run pumps manually. As the feed pump is discharging, adjust the balancing valve in discharge line until pressure reaches the rate pressure shown on submitted curve. Do not run 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 boilers are up to normal operating pressure, the balancing valve may have to be adjusted.
8. Adjust air PRV to steam flow regulator to maintain pressure at 5 to 10 psig under rated design load. Refer to steam valve manufacturer's bulletin for proper startup setting and adjustment procedure. (For pneumatic systems, air pressure to steam valve with a Spence "E" valve is 9 psig.)
9. Set pump selector switches on control panel at desired operating sequence. Refer to electrical schematic furnished with system.
10. Final adjustment of air PRV's should be made at this time with system operating under rated load condition to maintain water in storage at 227 Deg. F., and simultaneously maintaining a slight amount of flow out of the vent valve assembly. The type and quality of tank insulation as well as ambient temperature will be important factors in making the adjustment.
11. System should go through full cycle (2 to 4 hours) before making final control adjustment and test.
12. Check all steam supply and condensate return strainers; open blowdown valves (if furnished) to clean filters.
13. All components with internal (steam regulator pilot, make-up valve, etc.) strainers and water supply strainers need to be checked shortly after start-up, because of construction sediment and particles left in new piping and equipment.
14. In case of equipment or electrical component failure, do not attempt to correct unless a qualified service person is available, or call our Customer Service Department for information.
15. Blowdown all components such as make-up feeder valve, strainers, external float type controls, water gauges, equalizing lines, pump and tank drains, at regular intervals to prevent sediment buildup.
16. After startup is complete and system is thoroughly heated, pipe fittings should be checked for leakage and marked for later tightening. Some leakage may occur due to truck

vibration and movement of the assembly. All leaks must be tightened as soon as possible, preferably when the unit is cold.

## **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.

