.005 CC/LITER PRESSUREIZED DEAERATOR

INSTALLATION, OPERATING AND MAINTENANCE INSTRUCTIONS

FOR PDK SYSTEM (SPLIT TANK/CONTINUOUS CIRCULATION)

DESCRIPTION OF EQUIPMENT

Specific equipment furnished for this installation will be shown on the system lay out drawing and submittal sheet included in the instruction manual.

DESCRIPTION OF OPERATION

Basics requirements to effectively remove excess oxygen consist of:

1. Physical shake out of entrained gas by breaking up the condensate returns and make-up water into mist-like particles,
2. Be brought to the boiling point corresponding to the pressure at which it is held in storage, and
3. Through pressure and thermostatic controlled venting to atmosphere, quickly remove the liberated gases to prevent recontamination.

After steam pressure in receiver has reached the design psi:

The first requirement of PDK-5 system deaeration occurs when make-up water and condensate returns are admitted to the surge compartment through a set of spray nozzles into an internal pressurized vent condenser. The atomization and impingement process in the vent condenser will accomplish partial deaeration and pre-heating to 212 deg. F.

The second requirement is accomplished when the surge storage water is transferred to the deaerator compartment through an internal steam heater/scrubber device. This second process of steam entrainment and impingement will accomplish final deaeration and heating to 227 deg. F. NOTE; during low load or down time, the stored water will recirculate through the transfer pump and cause both compartments to contain fully deaerated 227 deg. F. water.

The third requirement is quick removal of the liberated gases, which is accomplished by the manual and thermostatic vent assembly. The manual valve will allow an orifice controlled continuous flow of steam to the atmosphere to allow constant removal of non-condensable gases. A thermostatic air vent will open when accumulation of air or oxygen is greater than the manual vent can handle.

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.

RETURNS: Connect pressure or pumped returns to inlet manifold or blending tee if furnished. These returns must be pumped to unit at a minimum pressure of 15 psig. Install check valve and "Y" strainer as close to receiver as possible in order to prevent water hammer or thermal shock.

Low-pressure Gravity returns (below 10 psig) cannot be directly admitted to the unit. Provide a condensate return unit and pump these returns to pressure or pumped returns inlet.

MAKE-UP SUPPLY: This is normally new water added from the water softener. 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 25 psi. Make-up valve is normally sized for 40 psi inlet pressure.

VENT: Install open vent pipe to atmosphere. (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 and should be avoided. Horizontal runs must have a trap or 3-leg drip loop to prevent condensate build-up. The automatic air vent will not have to be piped.

OVERFLOW AND DRIAN: 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 trap or drainer.

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. Install a drip tee at the inlet to the steam strainer and valve. A float and thermostatic trap must be installed at the bottom of the drip leg.

Steam piping and fittings installed should be rated for maximum steam supply pressure and capacity (1lbs/hr.).

VENT CONDENSER: Inlet piping manifold is factory prefabricated. On larger units, this piping may be dis-assembled to facilitate shipment. Reassemble this piping as match-marked by factory.

BOILER FEED PUMPS: Factory assembled units include suction line consisting of shut-off valve, compression coupling and necessary fittings.

Pump discharge piping, when furnished by factory; will be as shown on system layout drawing. Install square head balancing valve, unless furnished, between pump and boiler(s) as recommended on plans and/or specifications. Pump discharge piping installed in the field should include a spring-loaded check valve, gate valve and square head balancing valve. The balancing valve must be throttled to maintain pump discharge pressure as indicated on design data or system nameplate. Pipe sizing should be designed to allow no more than 10 FPS of water velocity or one size greater than the pump discharge opening in order to minimize friction losses and erosion.

When 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 check valve back to tank. Note that relief valves and differential regulators only work well when pump curves are steep enough to generate a sizeable differential between the operating point and zero flow.

LEVEL CONTROLS: All controllers are preset and adjusted by factory unless installed by others.

Controllers furnished with unit are generally float operated or probe type devices. Low alarm control setting is set to "make" at a point that provides a minimum water level of six inches above bottom of tank. When high alarm is furnished, it is set to "make" at 2 inches below the tank overflow connection. Refer to manufacture's bulletin for specific setting and adjustment data.

On small systems, the makeup control is a modulating type. The controller is a mechanical float operated feeder, factory mounted and piped. Larger units are provided with a probe type control system. Float or probe set point should be set to maintain a one-third water level in receiver, unless otherwise specified.

When displacement type controllers are specified, set the displacement type proportional band at approximately 30%. Refer to manufactures bulletin for specific setting and adjustment instructions.

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 the field by installing contractor.

AIR SUPPLY: An Air pressure filter regulator set to deliver 7 to 10 psi in furnished for controlling steam regulator supply pressure to inlet. Factory packaged units equipped with pneumatic level controls include an extra air pressure filter regulator set to deliver 20 psi. Connect air supply of 30 psi (minimum) to air pressure regulator inlet and install with shutoff cock for ease of maintenance.

INSULATION: For optimum thermal efficiency, it is recommended all tanks be insulated with two inches fiberglass and clad with a metal jacket unless otherwise specified. Steam supply and related piping should be insulated in field as required by safety specifications.

ELECTRICAL WIRING AND CONTROLS: Connect power leads in accordance with wiring diagram furnished with unit. Connect boiler level control leads to terminal points as indicated on wiring diagram. No other field connections should be necessary unless panel enclosure is removed from unit.

CHEMICAL TREATMENT: A small quantity of chemicals is usually required to “polish” the water and provide other boiler protection services. These chemicals may be introduced into the deaerator side tank providing they do not damage pumps or controls. Some chemicals can cause damage to pump seals. Such damage will not be covered by warranties from Sellers Manufacturing Company or the pump manufacturer. Chemical supplier should check with the pump manufacturer to answer suitability questions.

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. Check pump shaft rotation manually after opening suction line valves to be sure there is no binding. (Jog manual switch no longer than 2 seconds.)
2. Check pump motor alignment. If misalignment has occurred during transit, jobsite realignment is necessary. Refer to pump instruction bulleting for procedure.
3. Is pump discharger piping adequately supported to eliminate strain on casing?
4. Steam valve control pilot and tubing properly installed.
5. Check level control operating mechanisms and remove shipping devices so they switched operate freely.
6. Has system been installed level? Shim, if needed.
7. Air supply to pressure relief valve filter has been installed with “T” cock.
8. All strainer screens are installed and the blowdown pipe connected. A steam supply strainer and trap, if not furnished, should be installed on supply side of the steam regulator to prevent damage to pilot and regulator.
9. Power supply connected to panel. (Disconnect (s) and selector switches are “OFF.)
10. Power supply and motor voltage are compatible.
11. Control transformer is wired for proper primary voltage.
12. Motor wiring in motor terminal box has the correct leads that are wired to panel starters.
13. Pump “Start” pressure switch, if furnished, wired to correct panel terminal points.
14. Make-up valve and controller, if electric, wired to proper panel terminal points.
15. Boiler level controls properly wired to panel terminal strip. (NOTE: Boiler controller should have only one source of control voltage from either the deaerator panel or the boiler circuit – NEVER BOTH.)
16. All terminal connections are tight. Turn control circuit switch “ON.
17. Tank level alarm controls wired to proper panel terminal points. (Depress alarm silence button if low water alarm is sounding.)
18. Manhole and handhole bolts all in place and tight. Unused openings plugged.
19. Pressure and temperature gauges are properly located and have correct dial ranges.
20. Open ‘T” cocks on all pressure gauges.

21. Are dielectric fittings installed in all non-ferrous piping to unit?
22. Pump casing drain plugs are in place. (Use special drain plugs marked for pumps.)
23. Pump suction and discharge lines are open.
24. Check valves properly installed in direction of flow.
25. Fill tank after closing tank drains until low water indicator lights turns off and check for leaks.

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. The flowing hand valves are to be closed:
    - Tank and blowdown drains
    - Make-up (or transfer) by-pass
    - Compartment by-pass valve
    - Strainer blowdown valve
2. Open hand valves in the following sequence: (if contractor installs a valve between overflow trap and floor drain, please open.)
    a. Pump suction and discharge (boiler feed and transfer)
    b. Valves at inlet and outlet of the make-up valve
    c. Water gauge cocks
    d. Steam control pilot shut-off (if present)
    e. Air supply cock to air pressure relief valve-filter regulator(s)
    f. Equalizing line valves on external mounted controllers (if present)
    g. Gate valve on vent line
3. NOTE: All controls are factory set but minor adjustment may be made if necessary. As air supply cock is opened, gradually open valve in main steam supply line to regulator and adjust air filter regulator (if necessary) for steam valve pilot to maintain a minimum of 5 psig pressure in tank. Adjust second air filter regulator, if furnished, to deliver 20 psig (minimum) to modulating controller. Modulating make-up valve will open and admit water to the receiver. When water reaches the one-third level of the gauge glass, the unit will be primed and normal water level is attained. If a Magnetrol make-up pneumatic control is supplied, check and adjust modulating controller at this time to maintain a 4 to 6 inch proportional band with respect to the tank centerline. (See Magnetrol instructions.)
4. Engage Disconnect switch (es) to boiler feed and transfer 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 cicuit by opening tank drain valve and closing make-up inlet gate valve until level has receded to energize alarm horn. Alarm horn should sound

when water level is set at 6 inches above bottom of tank. Close drain valve and open make-up inlet valve. NOTE: Probe type controls are factory set and cannot be adjusted.

If unit is equipped with a high water alarm, open make-up nypass 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 inches below overlflow connection. Leave water in the tank when "Cold" start-up in necessary (no water in boiler).

6. Run each pump manually momentarily ("jog" manual for no longer than 2 seconds) and check for proper rotation. If rotation is incorrect, revers 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.)
7. After proper pump rotation has been established, continue to run transfer pump. (If two are furnished, turn one off.) Adjust each transfer pump discharge cock to supply 100% of the system capacity. Check the deaerator nameplate heating capacity to find the proper transfer pump GPM setting. See transfer pump curve at the proper GPM to determine proper pump pressure setting. If curve reads in feet of head, divide by 2.31 to find pump discharge pressure gauge reading. (NOTE: Pump selection curve in manual is marked to show 125% capacity to allow for future wear on the pump. Do not use this as the set point for the pump operation.)

CAUTION: NEVER RUN PUMPS DRY. SEAL FACES MAY BE DAMAGED IF OPERATED WITHOUT WATER!

After balancing cocks have been set, turn boiler feed pump selector switches to "OFF" position. Refer to pump manufacturers manual for further specific instruction.

8. Adjust air filter regulator to the steam flow regulator to maintain tank pressure at 5 to 10 psig under rated design load. Refer to the steam valve manufactures bulletin for proper start-up setting and adjustment procedure. After deaerator reaches the proper temperature of 227 deg. F., and steam purges tank of oxygen, close gate valve in vent line to reduce venting to a 3 to 3 ft. plume.
9. Set Boiler feed pump selector switches on control panel at desired operating sequence. Refer to electrical schematic furnish with system.
10. Final adjustment of air filter regulators should be made at this time with system operating under rated load condition so as to maintain water in storage at 227 deg. F. Maintain a slight amount of steam 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 this adjustment.

11. System should go through full cycle (two to four hours) before making final control adjustments 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 needs 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.

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 requited.
3. Check all internal rods, probes, anodes, surge shields and baffles for corrosion. Replace as soon as possible.