

MODEL TC – TANK CAR TRAY DEAERATOR

I. DEAERATOR DESIGN

Furnish and deliver one (1) vertical or horizontal direct contact two-stage tray type deaerator designed for counter flow operation, welded or bolted to a horizontal storage tank.

- A. The deaerator shall be designed for safe and reliable operation over the full load range from 10% to 100% of Design as shown below. **(Add additional thermal cases as required.)**

Design Point	Flow (lbs/hr)	Temp (F)	Enthalpy Btu/lb)	Pressure (psig)
Makeup				
Condensate				
Steam				
Other Flows				
Total Outlet				

- B. The deaerator shall be guaranteed to deliver the following:
- Water effluent within 2°F of the saturation temperature corresponding to the steam pressure within the deaerator.
 - Reduction of O₂ in effluent to 0.005 cc/liter (7ppb) or less when tested at the outlet of the deaerator in accordance with the Heat Exchange Institute Standards for Deaerators.
 - Reduction of the free CO₂ in effluent to 0 ppm when tested by the APHA method.
- C. The deaerator shall be a direct contact, spray-tray type unit designed for two-stage operation. The first stage shall consist of a stainless steel spray area containing spring-loaded, variable orifice spray valves, stainless steel vent condensing area and a stainless steel vent pipe positioned to permit efficient venting to the atmosphere. Spray valves shall be type 316 stainless steel and shall produce a hollow cone, thin-filmed spray pattern over the range of 5% to 200% of rated valve capacity to assure rapid heating and stable venting. Valves shall have Teflon guides to prevent binding and increase spray valve life.
- D. The second stage shall consist of tray assemblies housed in a tray enclosure constructed of stainless steel. Counterflow movement of water and steam shall be provided such that the water leaving the bottom layer of trays will be “stripped” by pure steam entering the heater. All materials, including heads and shells, in contact with steam which has previously been in contact with undeaerated water or partially deaerated water shall be stainless steel, stainless steel lined

or stainless steel clad. Trays shall be 430 stainless steel, not less than 20 gauge, and shall be stamped or riveted. Welding shall not be utilized for tray construction.

- E. The deaerator shall be designed, manufactured, tested and stamped in accordance with the ASME code Section VIII, Division I, and latest addenda. The design pressure shall be _____psig at _____Deg. F. (**Standard is 30 psig at 350F.**) A corrosion allowance of at least 1/16" (**1/8" optional**) shall be included.
- F. Provide a minimum storage capacity of ten (10) minutes at overflow based upon the design point. The overflow level shall not be closer to the top of the vessel than 85% of the tank diameter.
- G. All connections necessary to accommodate piping and specified accessories shall be provided. Screwed couplings shall be provided for connections 2" and smaller and 150 lb. RF flanged connections for larger connections. Access to deaerator internals shall be provided through an 18" diameter manway. The storage vessel shall be provided through a 12" x 16" manway.
- H. The vessel shall include heavy-duty saddles that provide adequate support.
- I. Insulation clips shall be provided.
- J. (**Recommended**) The following shall be included as recommended by HEI in order to prevent stress corrosion cracking:
- Post-weld Heat Treatment
 - Wet Fluorescent Magnetic Particle Inspection of interior nozzle to shell welds
 - Radiography to achieve a 1.0 joint efficiency
- K. The equipment shall be warranted from defects in materials and workmanship for a period of one (1) year from startup or 18 months after delivery, whichever occurs first.

II. DEAERATOR ACCESSORIES

The following accessories shall be included:

- A. One water inlet valve with stainless steel trim sized to pass _____ #/hr from _____ psig to the operating pressure. The valve shall be float controlled and lever actuated. **(OR)** The valve shall be pneumatically controlled with a diaphragm actuator.
- B. **(Optional)** Provide a strainer and three (3) valve bypass for the water inlet valve
- C. One steam pressure regulating valve to reduce available steam pressure from _____ psig to deaerator operating pressure. The valve shall be a self contained, pilot-operated, pressure regulator. **(OR)** The valve shall be complete with a pneumatic controller and diaphragm actuator.
- D. **(Optional)** Provide a three (3) valve bypass for the steam pressure reducing station.
- E. One sentinel relief valve set at the vessel design pressure. **(OR - recommended if a steam pressure reducing valve is in the scope of supply.)** Safety relief valve(s) sized to pass the fail open capacity of the steam pressure reducing valve in the event of failure. The valve(s) shall be set to relieve at deaerator design pressure.
- F. Two temperature gauges, 5" dial, bi-metallic, with stainless steel thermowells.
- G. One pressure gauge, 4-1/2", with siphon and cock.
- H. Vent valve with stainless steel trim.
- I. Vacuum breaker **(not applicable with full vacuum design)**.
- J. Overflow trap or valve with control to relieve full capacity of deaerator.
- K. Two level switches for high and low level alarm.
- L. Tubular **(OR magnetic, OR reflex)** gauge glass column with shutoff valves to cover the entire range of water travel in the storage section.
- M. Furnish bridle piping assemblies, pre-fit up to the deaerator bridle connections, for mounting of the level indicator, level switches and level control.

III. BOILER FEED PACKAGE

- A. Furnish ____ centrifugal boiler feed pump(s) having a capacity of _____ gpm and a total discharge head of _____ ft. Each pump shall be driven by a _____ volt, 3 phase, 60 Hz, open drip proof (ODP) (**OR TEFC**) motor. The pump(s) shall be bolted to a structural steel base.
- B. Provide a structural steel stand with square-tube support legs to assure the proper elevation required to meet the NPSHR of the boiler feed pumps.
- C. Interconnecting piping between the deaerator storage vessel and the pump suction shall be furnished, complete with a gate valve, strainer and flexible coupling.
- D. **(Optional)** Pump discharge piping with pressure gauge, check valve and shutoff valve shall be provided for each boiler feed pump.
- E. **(Optional)** Provide recirculation piping between each boiler feed pump and the deaerator storage vessel including a properly sized minimum flow orifice, check valve and shutoff valve (**OR automatic recirculation valve with shutoff valve**).
- F. A control panel is to be furnished completely wired, tested and mounted on the stand. The enclosure shall be NEMA 4 (**OR NEMA 12**) complete with fused protection, disconnect control circuit transformer, hand/off/auto switch, alarm horns and lights. Wiring shall be in accordance with the National Electric Code.
- G. **(Optional)** Provide starters for each boiler feed pump.
- H. All items will be factory preassembled to assure proper fit-up and shipped as fully assembled as is practical.
- I. **(Optional)** Service of a factory representative shall be included to check installation and instruct plant personnel in recommended operating and maintenance procedures.

TC1003.doc