BRINE HEATER CONDENSATE PUMP

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1. Duty of the Plant and Rangeability

The brine heater condensate pump evacuates the condensate produced in the brine heater during the process of transformation of the steam after the heat exchange with the recycling brine, and returns the same to the boiler feed water system.

This has to be carried out ensuring the condensate level in the brine heater is maintained to the desired value by throttling. A simplified flow sheet of the circuit is indicated in Figure 1.

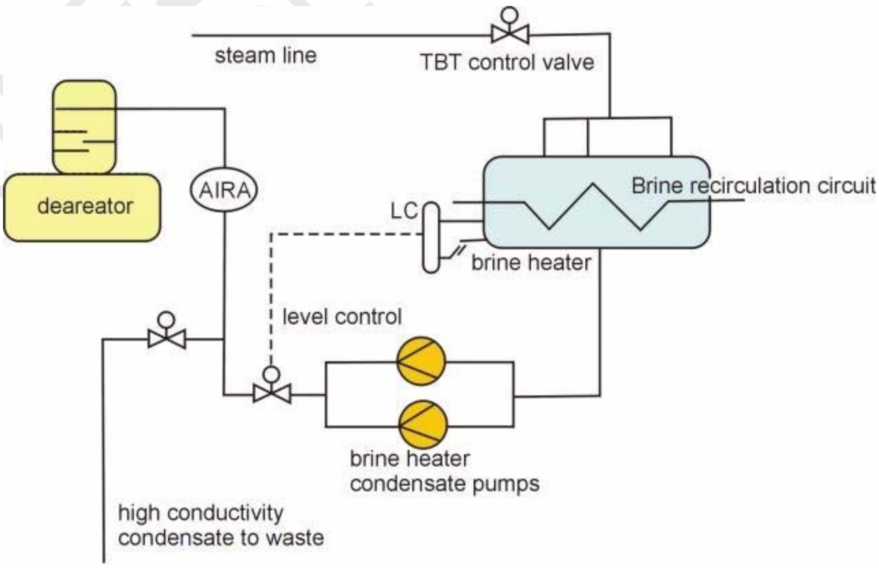

Figure 1. Circuit schematic diagram.

Due to the very delicate task of this pump, reliability is essential in order to prevent pump trips, which in turn would cause a shut down of the whole desalination unit. As a consequence of this it is also common good engineering practice to foresee the installation of a second 100 per cent standby pump in order to ensure the continuity of the operation. The suction conditions of this pump correspond to the absolute pressure in the brine heater plus the condensate starting load on the suction side.

Nominally the absolute pressure in the brine heater corresponds to the vapor tension of the condensate at the existing temperature during the operation. It is obvious therefore that the pump operates in very severe NPSH available conditions and that the definition of NPSHav must be thoroughly checked.

The following equations can be adopted.

$$NPSH_a \frac{P_s}{\gamma} - \frac{P_v}{\gamma} + z_a - y_a$$

where:

P_s = absolute pressure in the suction vessel (bar)
P_v = liquid absolute vapor tension (bar)
γ = specific gravity of the liquid (kg m^{-3})
z_a = geodetic suction height (m)
y_a = head loss in the suction pipe (m)

The relevant head entities are related to the following equations:

$$Hg = \left[\frac{Hcond - Hdea}{\rho g} \right]$$

$$Hm = \left[\frac{Pcond - Pdea}{\rho g} \right]$$

where:

Hg = geodetic head (m)
Hm = manometric head (bar)
Hcond = condensate level in the brine heater (m)
Hdea = boiler deaerator ref. level (m)
Pcond = brine heater pressure (bar)
Pdea = boiler deaerator pressure (bar)
ρ = fluid density (kg m^{-3})
g = gravity acceleration (9.81 m mec^{-2})

The experience suggests as general good engineering practise adopting a reference geodetical level (for instance the concrete level where the pump baseplate is lying) to refer to the NPSHav, and leaving the computation of the NPSHav to the manufacturer at impeller level on the basis of the geometry and dimensions of the pump he has adopted.

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