Boiler Blowdown

A blowdown of the boiler is a routine operation necessary due to the increased concentration of **Total Dissolved Solids –TDS** in the boiler during the steam production.

The blow down rate of a boiler depends on

- **Steam consumption (steam used in the process and not returned as condensate to the boiler)**
- **Concentration of impurities in the feed water**
- **Maximum allowable TDS in the boiler**

The blowdown rate can be calculated as

$q_{BD} = q_S f_c / (b_c - f_c)$ (1)

where

q_{BD} = blowdown rate (kg/h)

q_S = steam consumption (kg/h)

f_c = Total Dissolved Solids - TDS - in the feed water (ppm)

b_c = maximum allowable Total Dissolved Solids - TDS - in the boiler water (ppm)

Common Formula / Rule of Thumb

1 Boiler MW = 100HP = 1,000kW = 1,595 kg/hr (from & at 100°C at atmospheric pressure).

A lift of 1 metre imposes a back pressure of 10kPa.

The pressure in the condensate line generally will be 10% of the steam pressure.

If 1 litre of condensate is discharged to atmosphere, 10 % will flash off to steam.

Steam Trap Selection

For process applications –use a float or bucket type with inbuilt air vent

For main steam lines –use a thermodynamic

For Hospital Sterilisers –Use a balanced pressure type with near to steam element

For heat tracing –Use a bimetallic

Control Valve Sizing

For closed loop systems –size the valve with 20% pressure drop

For direct injection systems –size the valve with a 35% pressure drop

Tank Heating Steam Loads kg/hr

1a –If heating through a coil

$$\text{Steam Flow per hour} = \frac{4.19 \times \text{litres} \times (T1 - T2)}{\text{Latent Heat of Steam}}$$

1b –If direct injection

$$\text{Steam Flow per hour} = \frac{4.19 \times \text{litres} \times (T1 - T2)}{\text{Total Heat of Steam}}$$

Note – if heat up time was 30min, multiply above by 2, if 15mins multiply by 4 etc. if heat up time was 2 hours, divide above by 2 etc.

Tank Volume

Circular Tank Volume in litres = 3.14 x r2x h x 1000
(Note, r and h are in metres)

Heat Exchanger Steam Loads kg/hr

$$\text{Steam Flow per hour} = \frac{4.19 \times \text{litres/hr} \times (T1 - T2)}{\text{Latent Heat of Steam}}$$

Pipe Expansion

The table below can be used to calculate the expansion of steam pipes at different operating temperatures.

Steam Temperature (°C)	Expansion pr. 100m Pipe (mm)
66	63
93	96
121	136
149	166
177	203
204	246
232	279
260	323