Boiler Blowdown types and Boiler Blowdown calculation

What is boiler blowdown

Boiler blowdown means a certain volume of water is blown off through blowdown valve and is automatically replaced by feed water to maintain the desired level of total dissolved solids (TDS) in the boiler water.

Boiler feedwater usually contains a lot of dissolved and undissolved solids which is measured in total Dissolved Solids (TDS) contents in the boiler. These dissolved solids do not evaporate or escape during steam production and supply and settled at the bottomed the boiler shell or mud drum. These TDS causes serious trouble in boiler ie increase in scaling, corrosion, carryover localized overheating that may cause boiler tube failure or boiler explosion. Conductivity
measurement is used for monitoring the overall TDS present in the boiler. A rise in conductivity indicates a rise in the “contamination” of the boiler water.

Types of Boiler Blowdown

There are two types of boiler blowdown intermittent and continuous.

Intermittent or Periodic Blowdown

The intermittent blowdown is given by manually operating a valve fitted to discharge pipe at the lowest point of boiler shell to reduce parameters (IDS or conductivity, pH, Silica and Phosphates concentration) within prescribed limits so that steam quality is not likely to be affected. In intermittent blowdown, a large diameter line is opened for a short period of time, the time is based on a thumb rule such as “once in a shift for 2 minutes. Also, a substantial amount of heat energy is lost with intermittent blowdown. 16% of blowdown means a total heat loss of 0.42%, making it imperative to maintain blowdown as per the optimum requirement.

Continuous Blowdown

There is a steady and constant removal of a small stream of concentrated boiler water through continuous blowdown valve usually connected at the water level of the boiler, and replacement by the steady and constant inflow of feed water. This ensures constant TDS and steam purity at the given steam load. Once blowdown valve is set for a given condition, there is no need for the regular operation of the valve. This type of blowdown is common in high-pressure boilers and a heat recovery system is also instead to recover the heat of blowdown water.

Boiler Blowdown Calculation Formula

The quantity of blowdown in the steam boiler required to
control boiler water solids concentration is calculated by using the following formula:

\[
\text{Blow down (\%) = } \frac{[\text{Feed water TDS} \times \% \text{ Make up water}] \times 100}{(\text{Maximum Permissible TDS in Boiler water} - \text{Feed water TDS})}
\]

If maximum permissible limit of TDS as in a package boiler is 3000 ppm, percentage make up water is 10% and TDS in feed water is 300 ppm, then the percentage blow down is given as:

\[
= \frac{300 \times (10/100)}{3000 - 300} \times 100 = 1.11 \%
\]

If boiler evaporation rate is 3000 kg/hr then required blow down rate is:

\[
= \frac{3000 \times 1.11}{100} = 33.3 \text{ kg/hr}
\]

Typical maximum TDS for various boiler types:

<table>
<thead>
<tr>
<th>Boiler type</th>
<th>Maximum TDS (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lancashire</td>
<td>10 000</td>
</tr>
<tr>
<td>Two-pass economic</td>
<td>4 500</td>
</tr>
<tr>
<td>Packaged and three-pass economic</td>
<td>3 000 to 3 500</td>
</tr>
<tr>
<td>Low pressure water-tube</td>
<td>2 000 to 3 000</td>
</tr>
<tr>
<td>Coil boiler and steam generators (TDS in feedwater)</td>
<td>2 000</td>
</tr>
<tr>
<td>Medium pressure water-tube</td>
<td>1 500</td>
</tr>
<tr>
<td>High pressure water-tube</td>
<td>1 000</td>
</tr>
</tbody>
</table>

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