BLOWDOWN CALCULATION FOR BOILER

This term is the most important term in boiler operation and monitoring. The parameters of the blow down are to be maintained for particular boiler. This is due to the fact that water inside the boiler gets continuously evaporated due to steam generation. Concentration of dissolve solid, inside the drum increases and reach beyond the limit, so carryover of solids along with steam can occur. To prevent boiler tube chocking and overheating of the boiler tubes the blow down is necessary.

The blow down is the water removed from boiler to maintain the solids level in the boiler drum. This can be calculated as follows:

E = Evaporation or steam generation rate.

S = Amount of solids (ppm)

B = Blow down (m^3 / hr)

C = Maximum permissible concentration of solid inside the boiler drum

$$B = \frac{E \times S\ (m^3\ /\ hr.)}{C - S}$$

$$\%\ B = \frac{S}{C - S}$$

This formula has been equally applied to control individual constituents in boiler.

Blow down means, "lost heat". This is because any water, which is getting drained from the boiler drum, will be at the saturation temperature of steam and this has been heated starting from water of ambient temperature. Hence any reduction in this quantity of water would mean corresponding saving of fuel which can be qualified.

Regd. Office : 12/2881, "ALTRET" House, Sayedpura Main Road, Surat - 395 003. GUJ. INDIA.
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The chart attached showing volume of boiler Water Blow Liter/minute at various pressure and valve size in most common use:

- 1 kg / cm^2 = 14.2 PSIG

Garware-Wai Case Study:

Boiler capacity	= 2.5 TPH
Steam Pressure	= 9.5 kg/cm^2
Blowdown valve diameter	= 1 inch
Holdup volume	= 5 m^3
Feed water TDS	= 300 ppm (max.)
Existing Boiler water TDS	= 6000 ppm

As per formula:

$$\text{Blowdown} = \frac{300 \times 100}{6000 - 300}$$

$$= 5.263$$

For **2.5 TPH** capacity boiler

$$= 2.5 \times \frac{5.263}{100}$$

= 0.131
= 131 litres / hrs
= 3157 litres / day

Now as per chart **9.5 kg/cm^2**

At 9.50 kg/cm^2 by having 1 inch blowdown valve diameter, we can remove **480 lit / minute.**

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To remove 3157 liter/day, we need = $\frac{3157}{480}$

= **6.58 minutes** of total blow down.

Our current blow down confirms the above calculation. Based on above calculation, one can easily calculate the blow down needed to maintain the TDS at any level.

For above case, to maintain TDS at 3500

The water to be removed from the system is 5625 lit/day & the total required blow down time is **11.71** minutes.

B.O. Valve		1" Pipe		1.5" Pipe		2" Pipe		2.5" Pipe		3" Pipe	
Press.	Temp.	Litre /	Kg	Litre /	Kg	Litre /	Kg	Litre /	Kg	Litre /	Kg
Kg/cm^2	°C	Minute	Coal	Minute	Coal	Minute	Coal	Minute	Coal	Minute	Coal
7.04	167.22	435.84	14.98	1089.60	37.68	1852.32	64.47	2655.90	92.16	4767.00	165.71
8.80	178.33	463.08	16.80	1198.56	43.58	2015.76	73.55	2941.92	107.60	5039.40	184.32
10.56	185.56	503.94	19.07	1307.52	49.94	2233.68	85.35	3214.32	123.03	5448.00	208.39
12.32	191.67	544.80	21.34	1416.48	55.84	2451.60	97.16	3541.20	140.29	5856.60	231.99
14.08	197.78	599.28	24.52	1525.44	62.65	2669.52	109.41	3813.60	156.18	6265.20	256.96
15.85	202.78	653.76	27.69	1634.40	69.01	2860.20	120.31	4086.00	172.07	6673.80	281.03
17.61	207.78	708.24	29.96	1743.36	75.36	3105.36	134.38	4358.40	188.41	7082.40	306.45
21.13	216.11	789.96	35.41	1906.80	85.81	3386.84	152.09	4712.52	212.02	7845.12	353.21
24.65	223.89	817.20	39.50	2070.24	97.16	3650.16	171.16	5066.64	237.44	8607.84	404.51
28.17	231.11	926.16	44.95	2233.68	108.05	3940.72	191.13	5420.76	262.87	9397.80	455.82
31.69	237.22	1007.88	49.94	2397.12	119.40	4194.96	208.84	5774.88	287.84	10187.76	507.57

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