Boiler Water Treatment Helpful Hints

Useful Conversions		
1 Hp = 33,475 BTU/hr Output	1 Hp = 8lb. Wood	Natural Gas = 1000 Btu/ ft^3
1 Hp = 42,000 BTU/hr Input	1 ft^3 = 7.48 US Gal	#2 Fuel Oil = 140,000/ Gal
1 Hp = 34.5 lb. Steam/hr @ 212^0F	1 Gal H_2O = 8.34 lb.	#6 Fuel Oil = 150000/Gal
Hp = 4 gal/hr evaporation	1 Grain / Gal = 17.1 ppm	1 KW = 3415 Btu
Hp = 42 ft^3 Natural Gas	1 ppm = 0.0585 grains/gal	1 ft head water = 0.435 psi
1 Hp = 1/3 Gal. # 2 Oil	1 mg/l = 0.1 ppm	$^0F = (^0C \times 1.8) + 32$
1 Hp = 0.3 Gal # 6 Oil	1 ppm = 8.34 lb/ million Gal	$^0C = (^0F - 32) \times 0.555$
1 Hp = 4 lb. Coal	1 ppm = 1 lb/1 million lb H_2O	Blowdown Btu Loss = Blowdown
	1 Mil lb H_2O = 120000 Gal	Gal/hr x 256 Btu/ hr @ 40 psig

Cost of Water side deposit (100 Hp boiler operating at 100% of capacity)

Deposit Thickness	Efficiency Loss (%)	Gas Wastage	Oil Wastage	Coal Wastage
1/64 in.	4	168 ft^3/hr	1.2 Gal/hr	14.0 lb/hr
1/32	7	194	2.1	24.5
1/16	11	462	3.3	38.5
1/8	18	756	5.4	63.0
3/16	27	1123	8.1	94.5
1/4	28	1176	8.4	98.0
3/8	48	2016	14.4	168.0
1/2	50	2520	16.0	210.0

ABMA Boiler Water Limits

Boiler Pressure	TDS (ppm)	M Alk (ppm)	Silica (ppm)
0 - 300	3500	700	150
301 - 450	3000	600	90

Steam Output = Total Steam Produced by Boilers

Condensate Return = Condensed Steam which Returns to Boiler

Feed Water = Condensate Return + Fresh Make-up Water

Make-up = Fresh Water Required to replace blowdown + steam loss

Blowdown = Water Withdrawn to control boiler water solids (TDS/CND)

Btu = The Heat Required to Raise the Temperature of 1 lb of water 1^0F

Make-Up Water Required due to steam loss (evaporation) Determination

Hp	% Return (Gal) 10%	20%	30%	40%	50%	60%	70%	80%	90%
40	144	128	112	96	80	64	48	32	16
50	216	192	168	144	120	95	72	48	24
80	268	256	224	192	180	128	96	64	32
100	360	320	280	240	200	160	120	80	40
125	450	400	360	360	250	250	150	106	50
200	720	640	560	480	400	320	240	180	80
250	900	800	700	600	500	400	300	200	100

Formula = Hp x 4 x (1 - CR) = Make up Gallons per hour

Total Make-up water = Steam Loss + Blowdown Loss

Blowdown Loss = (Make-up Due to Steam Loss) / (Cyc les of Concentraion - 1)

Excessive Stack Temperature Chart

PSIG	Boiler H2O $^0F/^0C$	Max Stack $^0F/^0C$	PSIG	Boiler H2O $^0F/^0C$	Max Stack $^0F/^0C$
0	212/100	362/165	100	336/170	488/238
10	240/116	390/182	125	353/178	508/244
20	258/127	409/193	150	366/185	518/251
35	281/138	431/204	175	377/192	527/258
50	297/148	447/214	200	387/198	537/264
70	318/158	466/224	225	395/203	545/269
90	331/156	481/232	250	406208	556/274

Bon Aqua Requirements

Pipe Dia.	Units	Pipe Dia.	Units
<1.0"	2	10.0"	14
1.5"	3	12.0"	17
2.0"	4	14.0"	19
3.0"	5	16.0"	22
4.0"	7	18.0"	25
5.0"	8	20.0"	28
6.0"	9	24.0"	34
8.0"	12	36.0"	50