

Helpful Conversion Formulae (Steam, Hydronic, Electrical)

The following formulae are used in steam and hydronic calculations

Steam formulae

Multiply	By	To Obtain
BHP	33,479	BTU/HR
BHP	34.5	PPH steam
BHP	.069	GPM condensate
BHP	139	EDR steam
PPH steam	960	BTU/HR <small>low pressure</small>
PPH steam	.002	GPM condensate
PPH steam	4	EDR steam
EDR steam	.0005	GPM condensate

HVAC formulae

$$\text{BTUH} = \text{GPM} \times \Delta T \times 500 \times \text{SP. GR.} \times \text{SP. HT.}$$

$$\text{BTUH} = U \times \Delta T \times \text{LMTD}$$

Multiply	By	To Obtain
PSIG	2.31	FEET of water
PSIG	2.04	INCHES HG
INCHES HG	1.13	FEET of water
FEET of water	0.43	PSIG
GALLONS	8.345	LBS. of water
GALLONS	.134	Cubic Feet
CUBIC FEET _{water}	7.48	GALLONS
GPM	12,000	TONS _{EVAP}
GPM	15,000	TONS _{CONDENSOR}
BTUH	1000	MBH

Electrical formulae

$$\text{KW} = (\text{AMPS} \times \text{VOLTS} \times \text{POWER FACTOR} \times \sqrt{\text{PHASE}}) \div 1000$$

$$\text{AMPS} = (\text{HP} \times 746) \div (\text{VOLTS} \times \text{POWER FACTOR} \times \text{MOTOR EFF} \times \sqrt{\text{PHASE}})$$

$$\text{PUMP BHP} = (\text{GPM} \times \text{HEAD IN FEET} \times \text{SP. GR.}) \div (3960 \times \text{PUMP EFFICIENCY})$$

Multiply	By	To Obtain
HP	.746	KW
DIVIDE	By	To Obtain
BRAKE HP	MOTOR EFFICIENCY	INPUT HP

Steam properties

Properties of Saturated Steam

BELOW ATMOSPHERIC PRESSURE

Vacuum Inches of Mercury	Saturated Temp °F.	Specific Volume Cu. ft. per lb.	Heat Content Btu per lb.		Latent Heat of Vaporization Btu per lb.
			Saturated Liquid	Saturated Vapor	
29	79	857.0	47	1094	1047
27	115	231.9	83	1110	1027
25	134	143.0	102	1118	1017
20	161	74.8	129	1130	1001
15	179	51.2	147	1137	990
10	182	39.1	160	1142	982
5	203	31.8	171	1147	976
1	210	27.7	178	1150	971

ABOVE ATMOSPHERIC PRESSURE (Cont.)

Pressure PSI (Gauge)	Saturated Temp °F.	Specific Volume Cu. ft. per lb.	Heat Content Btu per lb.		Latent Heat of Vaporization Btu per lb.
			Saturated Liquid	Saturated Vapor	
150	366	2.75	337	1198	858
155	368	2.67	340	1198	854
160	370	2.60	342	1198	854
165	373	2.53	345	1197	852
170	375	2.47	347	1197	850
175	378	2.40	350	1198	848
180	380	2.34	352	1198	846
185	382	2.29	355	1199	844
190	384	2.23	357	1199	842
195	386	2.18	359	1199	840
200	388	2.14	361	1199	838
210	392	2.05	365	1200	835
220	396	1.98	369	1200	831
230	399	1.88	373	1201	828
240	403	1.81	377	1201	824
250	406	1.75	380	1201	821
260	410	1.68	384	1201	817
270	413	1.63	387	1202	814

ABOVE ATMOSPHERIC PRESSURE

Pressure PSI (Gauge)	Saturated Temp °F.	Specific Volume Cu. ft. per lb.	Heat Content Btu per lb.		Latent Heat of Vaporization Btu per lb.
			Saturated Liquid	Saturated Vapor	
0	212	28.8	180	1150	970
1	215	24.3	183	1151	967
2	218	23.0	186	1153	965
3	222	21.8	190	1154	963
4	224	20.7	193	1155	961
5	227	19.8	195	1156	959
6	230	18.9	198	1157	958
7	232	18.1	200	1158	956
8	235	17.4	203	1158	955
9	237	16.7	205	1158	953
10	239	16.1	208	1160	952
11	242	15.6	210	1161	950
12	244	15.0	212	1161	949
13	246	14.5	214	1162	947
14	248	14.0	216	1163	946
15	250	13.6	218	1164	945
16	252	13.2	220	1164	943
17	254	12.8	222	1165	942
18	255	12.5	224	1165	941
19	257	12.1	226	1166	940
20	259	11.1	227	1166	939
25	267	10.4	236	1169	933
30	274	9.4	243	1171	926
35	281	8.5	250	1173	923
40	287	7.74	256	1175	919
45	292	7.14	262	1177	914
50	298	6.62	267	1178	911
55	302	6.17	272	1179	907
60	307	5.79	277	1181	903
65	312	5.45	282	1182	900
70	316	5.14	286	1183	897
75	320	4.87	290	1184	893
80	324	4.64	294	1185	890
85	327	4.42	298	1186	888
90	331	4.24	301	1188	887
95	334	4.03	305	1190	884
100	338	3.88	308	1190	882
105	341	3.72	312	1189	877
110	343	3.62	314	1191	877
115	347	3.44	318	1191	872
120	350	3.34	321	1193	872
125	353	3.21	324	1193	867
130	355	3.12	327	1194	867
135	358	3.02	329	1194	864
140	361	2.92	332	1195	862
145	363	2.84	335	1196	860

Saturated Steam:

Pure steam at the temperature corresponding to the boiling point of water.

Pressure psig:

Gauge pressure expressed as lbs./sq. in. The pressure above that of atmosphere. It is pressure indicated on an ordinary pressure gauge.

Sensible Heat:

Heat which only increases the temperature of objects as opposed to latent heat. In the saturation tables it is the Btu remaining in the condensate at saturation temperature.

Latent Heat:

The amount of heat expressed in Btu required to change 1 lb. of water at saturation temperature into 1 lb. of steam. This same amount of heat must be given off to condense 1 lb. of steam back into 1 lb. of water. The heat value is different for every pressure temperature combination shown.

Total Heat:

The sum of the sensible heat in the condensate and the latent heat. It is the total heat above water at 32° F.

Specific Volume Cu. Ft. Per Lb.:

The volume of 1 lb. of steam at the corresponding pressure.