

3.1 WATER PRESSURE CONVERSION TABLES

Change Feet of Head To Pounds/Sq. In.		Changing Pounds/Sq. In. To Feet of Head	
Feet of Head	Lbs./Sq. In.	Lbs./Sq. In.	Feet of Head
1	.43	1	2.31
2	.87	2	4.62
3	1.30	3	6.96
4	1.73	4	9.24
5	2.17	5	11.54
6	2.60	6	13.85
7	3.03	7	16.16
8	3.40	8	18.47
9	3.90	9	20.78
10	4.33	10	23.09
20	8.66	15	34.63
30	12.99	20	46.18
40	17.32	25	57.72
50	21.65	30	69.27
60	25.99	40	92.36
70	30.32	50	115.45
80	34.65	60	138.54
90	38.98	70	161.63
100	43.31	80	184.72
110	47.64	90	207.81
120	51.97	100	230.90
130	56.30	110	253.98
140	60.63	120	277.07
150	64.96	125	288.62
160	69.29	130	300.16
170	73.63	140	323.25
180	77.96	150	346.34
190	83.29	160	369.43
200	86.62	170	392.52
225	97.45	180	415.61
250	108.27	190	438.90
275	119.10	200	461.78

3.2 CONVERSION FACTORS

HEAT

- 1 BTU = Amount of heat required to raise the temperature of 1 lb. of water 1°F.
- 1 Kilowatt Hour = 3412 B.T.U.
- 1 Therm = 100,000 B.T.U.
- 1 Decitherm = 10,000 B.T.U.
- 1 lb. "Propane" gas = 6.3 K.W.H. electricity
- 1 Therm - 4.65 lbs. "Propane" gas
- 1 lb. "Propane" gas = 2.15 decitherms

HEATING VALUES OF VARIOUS FUELS

- Coal = 25 million B.T.U. per ton (average).
- 1 ton coal = 2 cords wood (approx.)
- Oil (domestic grades) = 136,000 to 140,000 B.T.U. per gallon.
- Gas (manufactured) = 500 to 550 B.T.U. per cu. ft.
- Gas (natural) = 1000 to 1100 B.T.U. per cu. ft.
- Gas (propane) = 2509 B.T.U. per cu. ft. = 21,500 B.T.U. per lb. = 91,160 B.T.U. per ga.
- Gas (butane) - 3200 B.T.U. per cu. ft. = 21,300 B.T.U. per lb. = 100,000 B.T.U. per gal.

TEMPERATURE

- To convert from degrees Centigrade (C) to degrees Fahrenheit (F), multiply the number of degrees C, by 9/5 (or 1.8) and add 32.
- To convert from degrees Fahrenheit (F) to degrees Centigrade (C), first subtract 32 from the number of degrees F, then multiply the remainder by 5/9 (or 0.556).

PRESSURE

- 1 oz. per sq. in. = 1.73 in. water.
- 1 in. mercury = 7.85 oz. per sq. in.
- 1 in. mercury = 13.6 in. water.
- 1 in. water column = 0.578 oz. per sq. in.
- 1 oz. per sq. in. = 0.127 in. mercury.
- 1 in. water = 0.0735 in. mercury.
- 1 lb. per sq. in. = 16 oz. per sq. in. = 2.036 in. mercury = 27.7 in. water.
- 1 atmosphere = 14.7 lb. per sq. in. = 760 mm mercury = 29.92 in. mercury.

3.3 MISCELLANEOUS DATA

1 Ton Refrigeration	=	12,000 BTU/hr. 200 BTU/min.
1 BTU	=	6.65 grains (latent heat water vapor) 0.293 watt hours
1 Grain (water)	=	0.15 BTU (latent heat)
1 Pound	=	7,000 grains
1 Pound (air)	=	.24 BTU sensible heat per (°F.) 2.0416" Hg (64°F.)
1 lb./sq. in.	=	2.309 H ₂ O (62°F.)
1 atmosphere	=	14.7 lbs./sq. in.
1 watt hour	=	3.415 BTU
1 kilowatt	=	1.34 horse power 56.92 BTU/min.
1 Horsepower	=	0.746 kilowatts 42.44 BTU/min.
1 Boiler H.P.	=	33.523 BTU/hr.
1 Gallon (US)	=	23.1 cu. in. 8.34 lbs. (water 60°F.)
1 Cu. Ft. (water)	=	62.37 pounds 7.45 gallons (US)

3.4 GAS TYPES AND THEIR COMBUSTION CHARACTERISTICS

	Manu- factured	Natural	Mixed	Pro- pane	Bu- tane
Specific Gravity, (Air = 1)	0.40-0.70	0.60-0.70	0.60	1.52	2.00
Heating Value, BTU/cu. ft.	520-600	1000-1200	800	2570	3260
Explosive Limits, %Gas in Air					
Lower	5.6	4.8		2.4	1.9
Upper	31.7	14.0		9.5	8.4
Main Constituents, %					
Hydrogen	50		25		
Carbon Monoxide	10		5		
Methane	25	90	60		
Ethane		5	3	3	
Propane				97	6
Butane					94
Cu. Ft. of air required for Complete combustion of one Cu. Ft. of gas	5	10	8	24	31

3.5 COMPARISON OF PROPERTIES OF PROPANE AND BUTANE

Property	Propane	Butane
1. BTU per lb. of gas	21,600	21,300
2. Lbs. per gallon of liquid	4.24	4.86
3. Cu. ft. of gas per lb.	8.59	6.51
4. Cu. ft. of gas per gal.	36.5	31.8
5. Boiling point of liquid at atmospheric pressure	-44°F.	32°F.
6. Vapor pressure lbs. per sq. in. gage at 60°F.	92	12
at 100°F.	172	37

3.6 FLOW OF WATER IN HOUSE SERVICE PIPES

(To find the discharge in gallons, multiply by 7.47)
(Thomson Meter Company)

Condition of Discharge	Pressure in Main Pounds, per Square Inch	Discharge in Cubic Feet per Minute from the Pipe								
		Nominal Diameters of Iron or Lead Service Pipe in Inches								
		1/2	5/8	3/4	1	1 1/2	2	3	4	6
Through 35 ft. of service pipe; no back-pressure.	30	1.10	1.92	3.01	6.13	16.58	33.34	88.16	173.85	444.63
	40	1.27	2.22	3.48	7.08	19.14	38.50	101.80	200.75	513.42
	50	1.42	2.48	3.89	7.92	21.40	43.04	113.82	224.44	574.02
	60	1.56	2.71	4.26	8.67	23.44	47.15	124.68	245.87	628.81
	75	1.74	3.03	4.77	9.70	26.21	52.71	139.39	274.89	702.03
Through 100 ft. of service pipe; no back-pressure.	100	2.01	3.50	5.50	11.20	30.27	60.87	160.96	317.41	811.79
	130	2.29	3.99	6.28	12.77	34.51	69.40	183.52	361.91	925.58
	30	0.66	1.16	1.84	3.78	10.40	21.30	58.19	118.13	317.23
	40	0.77	1.34	2.12	4.36	12.01	24.59	67.19	136.41	366.30
	50	0.86	1.50	2.37	4.88	13.43	27.50	75.13	152.51	409.54
Through 100 ft. of service pipe and 15 ft. vertical rise.	60	0.94	1.65	2.60	5.34	14.71	30.12	82.30	167.06	448.63
	75	1.05	1.84	2.91	5.97	16.45	33.68	92.01	186.78	501.58
	100	1.22	2.13	3.36	6.90	18.99	38.89	106.24	215.68	579.18
	130	1.39	2.42	3.83	7.86	21.66	44.34	121.14	245.91	660.36
	Through 100 ft. of service pipe and 30 ft. vertical rise.	30	0.55	0.96	1.52	3.11	8.57	17.55	47.90	97.17
40		0.66	1.15	1.81	3.72	10.24	20.95	57.20	116.01	311.09
50		0.75	1.31	2.06	4.24	11.67	23.87	65.18	132.20	354.49
60		0.83	1.45	2.29	4.70	12.94	26.48	72.28	146.61	383.13
75		0.94	1.64	2.59	5.32	14.64	29.96	81.79	165.90	444.85
Through 100 ft. of service pipe and 30 ft. vertical rise.	100	1.10	1.92	3.02	6.21	17.10	35.00	95.55	193.82	519.31
	130	1.26	2.20	3.48	7.14	19.55	40.23	109.82	222.75	597.31
	30	0.44	0.77	1.22	2.50	6.80	14.11	38.63	78.54	211.54
	40	0.55	0.97	1.53	3.15	8.68	17.79	48.68	98.98	266.59
	50	0.65	1.14	1.79	3.69	10.16	20.82	56.98	115.87	312.08
Through 100 ft. of service pipe and 30 ft. vertical rise.	60	0.73	1.28	2.02	4.15	11.45	23.47	64.22	130.59	351.73
	75	0.84	1.47	2.32	4.77	13.15	26.95	73.76	149.99	403.98
	100	1.00	1.74	2.75	5.65	15.58	31.93	87.38	177.67	478.55
130	1.15	2.02	3.19	6.55	18.07	37.02	101.33	206.04	554.96	

TECHNICAL DATA

4.1 GAS BURNER INPUT TABLE GAS INPUT TO BURNER IN CUBIC FEET PER HOUR

Seconds For One Revolution	SIZE OF TEST METER DIAL				Seconds For One Revolution	SIZE OF TEST METER DIAL			
	One-Half Cu. Ft.	One Cu. Ft.	Two Cu. Ft.	Five Cu. Ft.		One-Half Cu. Ft.	One Cu. Ft.	Two Cu. Ft.	Five Cu. Ft.
10	180	360	720	1800	36	50	100	200	500
11	164	327	655	1636	37	49	97	195	486
12	150	300	600	1500	38	47	95	189	474
13	138	277	555	1385	39	46	92	185	462
14	129	257	514	1286	40	45	90	180	450
15	120	240	480	1200	41	44	88	176	440
16	112	227	450	1125	42	43	86	172	430
17	106	212	424	1059	43	42	84	167	420
18	100	200	400	1000	44	41	82	164	410
19	95	189	379	947	45	40	80	160	400
20	90	180	360	900	46	39	78	157	391
21	86	171	343	857	47	38	77	153	383
22	82	164	327	818	48	37	75	150	375
23	78	157	313	783	49	37	73	147	367
24	75	150	300	750	50	36	72	144	360
25	72	144	288	720	51	35	71	141	353
26	69	138	277	692	52	35	69	138	346
27	67	133	267	667	53	34	68	136	340
28	65	129	257	643	54	33	67	133	333
29	62	124	248	621	55	33	65	131	327
30	60	120	240	600	56	32	64	129	321
31	68	116	232	581	57	32	63	126	316
32	56	113	225	563	58	31	62	124	310
33	55	109	218	545	59	30	61	122	305
34	53	106	212	529	60	30	60	120	300
35	51	103	206	515					

NOTE: To convert to BTU per hour multiply by the BTU heating value of the gas used.

Reproduced from AMERICAN GAS ASSOCIATION STANDARD Z21.30 by permission of American Gas Association, Inc., New York, N.Y.

4.2 GAS PRESSURE CONVERSION TABLE

Inches—Water Column	Ounces
3"	1.71
4"	2.27
5"	2.85
6"	3.43
7"	4.00
8"	4.55
9"	5.12
10"	5.70
11"	6.25

4.5 MAXIMUM CAPACITY OF PIPE IN CUBIC FEET OF GAS PER HOUR

(Based upon a Pressure Drop of 0.5 Inch Water Column and 0.6 Specific Gravity Gas)

Length in Feet	Nominal Iron Pipe Size, Inches								
	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4
10	175	360	680	1,400	2,100	3,950	6,300	11,000	23,000
20	120	250	465	950	1,460	2,750	4,350	7,700	15,800
30	97	200	375	770	1,180	2,200	3,520	6,250	12,800
40	82	170	320	660	990	1,900	3,000	5,300	10,900
50	73	151	285	580	900	1,680	2,650	4,750	9,700
60	66	138	260	530	810	1,520	2,400	4,300	8,800
70	61	125	240	490	750	1,400	2,250	3,900	8,100
80	57	118	220	460	690	1,300	2,050	3,700	7,500
90	53	110	205	430	650	1,220	1,950	3,450	7,200
100	50	103	195	400	620	1,150	1,850	3,250	6,700
125	44	93	175	360	550	1,020	1,650	2,950	6,000
150	40	84	160	325	500	950	1,500	2,650	5,500
175	37	77	145	300	460	850	1,370	2,450	5,000
200	35	72	135	280	430	800	1,280	2,280	4,600

4.3 PIPE SIZE SELECTION TABLE IRON PIPE TO COPPER TUBE

Iron Pipe Nominal Size	Corresponding Suitable Sizes for Copper Tube	
	Hot Water	Cold Water
1/2 inch	3/8 inch	3/8 inch
3/4 inch	1/2 inch	1/2 inch
1 inch	3/4 inch	3/4 inch
1 1/4 inch	1 inch	1 inch
1 1/2 inch	1 inch	1 1/4 inch
2 inch	1 1/4 inch	1 1/2 inch
2 1/2 inch	1 1/2 inch	2 inch
3 inch	2 inch	2 1/2 inch

4.6 MAXIMUM CAPACITY OF PIPE IN THOUSANDS OF BTU/H

OF UNDILUTED LIQUEFIED PETROLEUM GASES

(Based on a Pressure Drop of 0.5 Inch Water Column)

Nominal Iron Pipe Size, Inches	Length of Pipe (Feet)														
	10	20	30	40	50	60	70	80	90	100	125	150			
1/2	275	189	152	129	114	103	96	89	83	78	69	63			
3/4	567	393	315	267	237	217	196	185	173	162	146	132			
1	1071	732	590	504	448	409	378	346	322	307	275	252			
1 1/4	2205	1496	1212	1039	913	834	771	724	677	630	567	511			
1 1/2	3307	2299	1858	1559	1417	1275	1181	1086	1023	976	866	787			
2	6221	4331	3465	2992	2646	2394	2205	2047	1921	1811	1606	1496			

4.4 MAXIMUM CAPACITY OF PIPE IN CUBIC FEET OF GAS PER HOUR

(Based upon a Pressure Drop of 0.3 Inch Water Column and 0.6 Specific Gravity Gas)

Length in Feet	Nominal Iron Pipe Size, Inches									
	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	
10	132	278	520	1,050	1,600	3,050	4,800	8,500	17,500	
20	92	190	350	730	1,100	2,100	3,300	5,900	12,000	
30	73	152	285	590	890	1,650	2,700	4,700	9,700	
40	63	130	245	500	760	1,450	2,300	4,100	8,300	
50	56	115	215	440	670	1,270	2,000	3,600	7,400	
60	50	105	195	400	610	1,150	1,850	3,250	6,800	
70	46	96	180	370	560	1,050	1,700	3,000	6,200	
80	43	90	170	350	530	990	1,600	2,800	5,800	
90	40	84	160	320	490	930	1,500	2,600	5,400	
100	38	79	150	305	460	870	1,400	2,500	5,100	
125	34	72	130	275	410	780	1,250	2,200	4,500	
150	31	64	120	250	380	710	1,130	2,000	4,100	
175	28	59	110	225	350	650	1,050	1,850	3,800	
200	26	55	100	210	320	610	980	1,700	3,500	

4.7 MULTIPLIERS TO BE USED ONLY WITH TABLES 4.4, 4.5 AND 4.6 WHEN APPLYING THE GRAVITY FACTOR

Specific Gravity	Multiplier	Specific Gravity	Multiplier
.35	1.31	1.00	.78
.40	1.23	1.10	.74
.45	1.16	1.20	.71
.50	1.10	1.30	.68
.55	1.04	1.40	.66
.60	1.00	1.50	.63
.65	.96	1.60	.61
.70	.93	1.70	.59
.75	.90	1.80	.58
.80	.87	1.90	.56
.85	.84	2.00	.55
.90	.82	2.10	.54