



Gas Pipe Line Calculation Sizing

USING CPC PIPE SIZING TABLE (PROPANE)

This handout will guide you thru the basic, most common method for sizing a propane piping system for residential or commercial application. There are other methods available for sizing these systems by either a complex formulaic method described in the California Plumbing Code, or the system can be engineered by a qualified professional.

The information below is paraphrased from the California Plumbing Code and is provided as an aid.

Sizing of Gas Piping Systems.

Gas piping systems shall be of such size and so installed as to provide a supply of gas to meet the maximum demand and supply gas to each appliance inlet at not less than the minimum supply pressure required by the appliance.

Required Gas Supply.

Volume. The hourly volume of gas required at each piping outlet shall be taken as not less than the maximum hourly BTU rating as specified by the manufacturer of the appliance or appliances to be connected to each such outlet. Where the rating of the gas appliance(s) to be installed is unknown, Table 1 shall be permitted to be used to estimate the requirements of typical appliances.

Longest Length Method. The size of each section of gas piping shall be determined using the total length of piping from the meter to the most remote outlet and the load of that section (see calculation example in "Figure A" use steps 1- 6 below:

Sizing of Piping Sections. To determine the size of each section of pipe in any system using piping specific table*, and proceed as follows:

- (1) Measure the length of the pipe from the gas meter location to the most remote outlet on the system.
- (2) Locate that total length in the left-hand column of sizing table*, or the next longer distance where the table does not give the exact length.
- (3) Starting at the most remote outlet, find in the row just selected the gas demand for the outlet. Where the exact figure of demand is not shown, choose the next larger figure in the row.
- (4) At the top of this column will be found the correct size of pipe.
- (5) Using this same row, proceed in a similar manner for each section of pipe serving this outlet. For each section of pipe, determine the total gas demand supplied by that section.
- (6) Size each section of branch piping not previously sized by measuring the distance from the gas meter location to the most remote outlet in that branch and follow the procedures of steps 2, 3, 4, and 5 above. Size branch piping in the order of their distance from the meter location, beginning with the most distant outlet not previously sized.

*See Pipe Specific Tables on pages 4, 5, and 6.

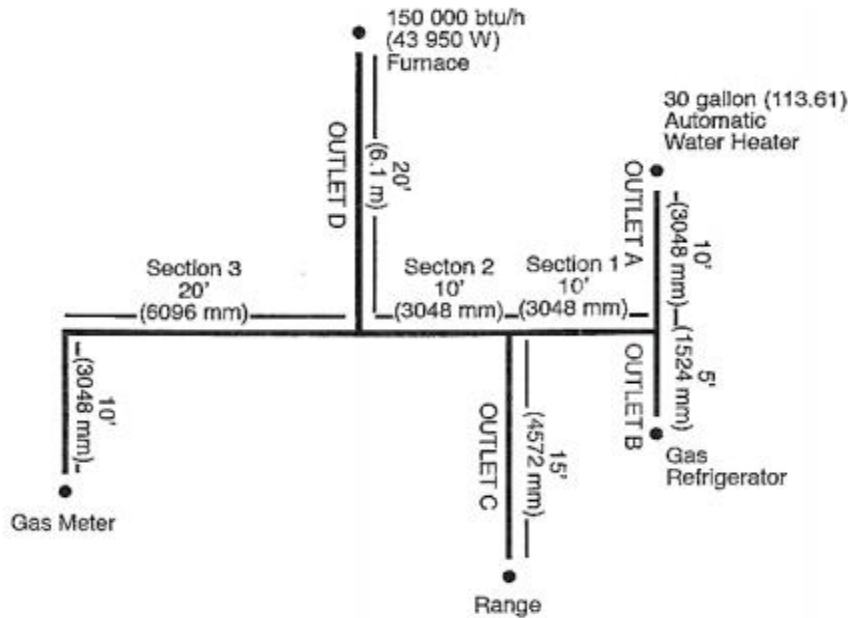
TABLE 1**APPROXIMATE GAS INPUT FOR TYPICAL APPLIANCES**

APPLIANCE	INPUT Btu/h. (Approx.)	Cubic Feet of Gas Per Hour
<u>Space Heating Units</u>		
Warm air furnaces:		
Single family	100,000	91
Multifamily, per unit	60,000	55
Hydronic boilers:		
Single family	100,000	91
Multifamily, per unit	60,000	55
<u>Space and Water-Heating Units</u>		
Hydronic boilers:		
Single family	120,000	109
Multifamily, per unit	75,000	68
<u>Water-Heating Appliances</u>		
Water heater, automatic:		
Storage 30 to 40 gal. tank	35,000	32
Water heater, automatic		
Storage 50 gal. tank	50,000	45
Water heater, automatic instantaneous:		
Capacity at 2 gal./minute	142,800	130
Capacity at 4 gal./minute	285,000	259
Capacity at 6 gal./minute	428,400	389
Water heater, domestic		
Circulation or side-arm	35,000	32
<u>Cooking Appliances</u>		
Range, freestanding, domestic	65,000	59
Built-in oven/ broiler, domestic	25,000	23
Built-in counter-top range, domestic	40,000	36
<u>Other Appliances</u>		
Clothes dryer, domestic	35,000	32
Gas fireplace – direct vent	40,000	36
Gas log unit	80,000	73
Barbecue	40,000	36
Gas Refrigerator	3,000	2

For SI units: 1 Btu per hour = .0293 W

FIGURE A

SAMPLE SCHEMATIC DRAWING



Method for determining correct pipe sizing per 1216.1.1:

- (1) Compute BTU demand for all appliances

Maximum gas demand of outlet A:

35,000

Maximum gas demand of outlet B:

3,000

Maximum gas demand of outlet C:

65,000

Maximum gas demand of outlet D:

150,000

Total BTU demand 253,000 BTU (35,000 + 3,000 + 65,000 + 150,000)

- (2) Determine the length of pipe from the gas meter to the most remote outlet (outlet A) is 60 feet.

Sec 1 (10) + Sec 2 (10) + Sec 3 (30) = 60

- (3) Using the length in feet column row marked 60 feet in Table sizing table:

Outlet A, supplying 32 cubic feet per hour, requires ½ inch pipe.

Section 1, supplying outlets A and B, or 35 cubic feet per hour requires ½ inch pipe.

Section 2, supplying outlets A, B, and C, or 94 cubic feet per hour requires 1/2 inch pipe.

Section 3, supplying outlets A, B, C, and D, or 230 cubic feet per hour, requires 3/4 inch pipe.

FUEL GAS PIPING

TABLE 1216.2(27)
SCHEDULE 40 METALLIC PIPE [NFPA 54: TABLE 6.3(d)]*

		GAS: UNDILUTED PROPANE							
		INLET PRESSURE: 11.0 in. w.c.							
		PRESSURE DROP: 0.5 in. w.c.							
		SPECIFIC GRAVITY: 1.50							
INTENDED USE: PIPE SIZING BETWEEN SINGLE OR SECOND STAGE (LOW PRESSURE) REGULATOR AND APPLIANCE									
PIPE SIZE (inch)									
NOMINAL INSIDE:	½	¾	1	1¼	1½	2	2½	3	4
ACTUAL ID:	0.622	0.824	1.049	1.380	1.610	2.067	2.469	3.068	4.026
LENGTH (feet)	CAPACITY IN THOUSANDS OF BTU PER HOUR								
10	291	608	1150	2350	3520	6790	10 800	19 100	39 000
20	200	418	787	1620	2420	4660	7430	13 100	26 800
30	160	336	632	1300	1940	3750	5970	10 600	21 500
40	137	287	541	1110	1660	3210	5110	9030	18 400
50	122	255	480	985	1480	2840	4530	8000	16 300
60	110	231	434	892	1340	2570	4100	7250	14 800
80	101	212	400	821	1230	2370	3770	6670	13 600
100	94	197	372	763	1140	2200	3510	6210	12 700
125	89	185	349	716	1070	2070	3290	5820	11 900
150	84	175	330	677	1010	1950	3110	5500	11 200
175	74	155	292	600	899	1730	2760	4880	9950
200	67	140	265	543	814	1570	2500	4420	9010
250	62	129	243	500	749	1440	2300	4060	8290
300	58	120	227	465	697	1340	2140	3780	7710
350	51	107	201	412	618	1190	1900	3350	6840
400	46	97	182	373	560	1080	1720	3040	6190
450	42	89	167	344	515	991	1580	2790	5700
500	40	83	156	320	479	922	1470	2600	5300
550	37	78	146	300	449	865	1380	2440	4970
600	35	73	138	283	424	817	1300	2300	4700
650	33	70	131	269	403	776	1240	2190	4460
700	32	66	125	257	385	741	1180	2090	4260
750	30	64	120	246	368	709	1130	2000	4080
800	29	61	115	236	354	681	1090	1920	3920
850	28	59	111	227	341	656	1050	1850	3770
900	27	57	107	220	329	634	1010	1790	3640
950	26	55	104	213	319	613	978	1730	3530
1000	25	53	100	206	309	595	948	1680	3420
1100	25	52	97	200	300	578	921	1630	3320
1200	24	50	95	195	292	562	895	1580	3230
1300	23	48	90	185	277	534	850	1500	3070
1400	22	46	86	176	264	509	811	1430	2930
1500	21	44	82	169	253	487	777	1370	2800
1600	20	42	79	162	243	468	746	1320	2690
1700	19	40	76	156	234	451	719	1270	2590
1800	19	39	74	151	226	436	694	1230	2500
1900	18	38	71	146	219	422	672	1190	2420
2000	18	37	69	142	212	409	652	1150	2350

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm, 1000 British thermal units per hour = 0.293 kW, 1 inch water column = 0.249 kPa
* Table entries are rounded to 3 significant digits.

**TABLE 1216.2(34)
POLYETHYLENE PLASTIC PIPE [NFPA 54-12: TABLE 6.3(k)]***

		GAS: UNDILUTED PROPANE						
		INLET PRESSURE: 11.0 in. w.c.						
		PRESSURE DROP: 0.5 in. w.c.						
		SPECIFIC GRAVITY: 1.50						
INTENDED USE: PE SIZING BETWEEN INTEGRAL SECOND-STAGE REGULATOR AT TANK OR SECOND-STAGE (LOW PRESSURE) REGULATOR AND BUILDING								
		PIPE SIZE (inch)						
NOMINAL OD:	½	¾	1	1¼	1½	2	3	4
DESIGNATION:	SDR 9.3	SDR 11	SDR 11	SDR 10	SDR 11	SDR 11	SDR 11	SDR 11
ACTUAL ID:	0.660	0.860	1.077	1.328	1.554	1.943	2.864	3.682
LENGTH (feet)	CAPACITY IN THOUSANDS OF BTU PER HOUR							
10	340	680	1230	2130	3210	5770	16 000	30 900
20	233	468	844	1460	2210	3970	11 000	21 200
30	187	375	677	1170	1770	3180	8810	17 000
40	160	321	580	1000	1520	2730	7540	14 600
50	142	285	514	890	1340	2420	6680	12 900
60	129	258	466	807	1220	2190	6050	11 700
70	119	237	428	742	1120	2010	5570	10 800
80	110	221	398	690	1040	1870	5180	10 000
90	103	207	374	648	978	1760	4860	9400
100	98	196	353	612	924	1660	4590	8900
125	87	173	313	542	819	1470	4070	7900
150	78	157	284	491	742	1330	3690	7130
175	72	145	261	452	683	1230	3390	6560
200	67	135	243	420	635	1140	3160	6100
250	60	119	215	373	563	1010	2800	5410
300	54	108	195	338	510	916	2530	4900
350	50	99	179	311	469	843	2330	4510
400	46	92	167	289	436	784	2170	4190
450	43	87	157	271	409	736	2040	3930
500	41	82	148	256	387	695	1920	3720

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm, 1000 British thermal units per hour = 0.293 kW, 1 inch water column = 0.249 kPa

* Table entries are rounded to 3 significant digits.

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TABLE 1216.2(29)
SEMI-RIGID COPPER TUBING [NFPA 54: TABLE 6.3(f)]^{2, 3}

		GAS: UNDILUTED PROPANE								
		INLET PRESSURE: 11.0 in. w.c.								
		PRESSURE DROP: 0.5 in. w.c.								
		SPECIFIC GRAVITY: 1.50								
INTENDED USE: TUBE SIZING BETWEEN SINGLE OR SECOND STAGE (LOW PRESSURE) REGULATOR AND APPLIANCE										
		TUBE SIZE (inch)								
NOMINAL:	K & L:	¼	⅜	½	⅝	¾	1	1¼	1½	2
	ACR:	⅜	½	⅝	¾	7⁄8	1½	1¾	—	—
OUTSIDE:		0.375	0.500	0.625	0.750	0.875	1.125	1.375	1.625	2.125
INSIDE: ¹		0.305	0.402	0.527	0.652	0.745	0.995	1.245	1.481	1.959
LENGTH (feet)		CAPACITY IN THOUSANDS OF BTU PER HOUR								
10	45	93	188	329	467	997	1800	2830	5890	
20	31	64	129	226	321	685	1230	1950	4050	
30	25	51	104	182	258	550	991	1560	3250	
40	21	44	89	155	220	471	848	1340	2780	
50	19	39	79	138	195	417	752	1180	2470	
60	17	35	71	125	177	378	681	1070	2240	
70	16	32	66	115	163	348	626	988	2060	
80	15	30	61	107	152	324	583	919	1910	
90	14	28	57	100	142	304	547	862	1800	
100	13	27	54	95	134	287	517	814	1700	
125	11	24	48	84	119	254	458	722	1500	
150	10	21	44	76	108	230	415	654	1360	
175	NA	20	40	70	99	212	382	602	1250	
200	NA	18	37	65	92	197	355	560	1170	
250	NA	16	33	58	82	175	315	496	1030	
300	NA	15	30	52	74	158	285	449	936	
350	NA	14	28	48	68	146	262	414	861	
400	NA	13	26	45	63	136	244	385	801	
450	NA	12	24	42	60	127	229	361	752	
500	NA	11	23	40	56	120	216	341	710	
550	NA	11	22	38	53	114	205	324	674	
600	NA	10	21	36	51	109	196	309	643	
650	NA	NA	20	34	49	104	188	296	616	
700	NA	NA	19	33	47	100	180	284	592	
750	NA	NA	18	32	45	96	174	274	570	
800	NA	NA	18	31	44	93	168	264	551	
850	NA	NA	17	30	42	90	162	256	533	
900	NA	NA	17	29	41	87	157	248	517	
950	NA	NA	16	28	40	85	153	241	502	
1000	NA	NA	16	27	39	83	149	234	488	
1100	NA	NA	15	26	37	78	141	223	464	
1200	NA	NA	14	25	35	75	135	212	442	
1300	NA	NA	14	24	34	72	129	203	423	
1400	NA	NA	13	23	32	69	124	195	407	
1500	NA	NA	13	22	31	66	119	188	392	
1600	NA	NA	12	21	30	64	115	182	378	
1700	NA	NA	12	20	29	62	112	176	366	
1800	NA	NA	11	20	28	60	108	170	355	
1900	NA	NA	11	19	27	58	105	166	345	
2000	NA	NA	11	19	27	57	102	161	335	

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm, 1000 British thermal units per hour = 0.293 kW, 1 inch water column = 0.249 kPa

Notes:

¹ Table capacities are based on Type K copper tubing inside diameter (shown), which has the smallest inside diameter of the copper tubing products.

² Table entries are rounded to 3 significant digits.

³ NA means a flow of less than 10 000 Btu/h (2.93 kW).