

Gas Pipe Line Calculation Sizing – For Steel Pipe

Using CPC Pipe Sizing Table (Natural Gas)

This handout will guide you thru the basic, most common method for sizing a natural gas piping system for any 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 to designers, contractors and homeowners who are installing or modifying a schedule 40 steel pipe, natural gas piping system.

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.

Maximum Gas Demand. The volumetric flow rate of gas to be provided (in cubic feet per hour) shall be calculated using the manufacture's input ratings of the appliance served, adjusted for altitude. Where the input rating is not indicated, the gas supplier, appliance manufacturer, or qualified agency shall be contacted or the rating from Table shall be used for estimating the volumetric flow rate of gas to be supplied. **(USE 1,100)**

The total connected hourly load shall be used as the basis for pipe sizing, assuming the appliances are operating in full capacity simultaneously.

Required Gas Supply.

Volume. The hourly volume of gas required at each piping outlet shall be taken as not less than the maximum hourly 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 requirements of typical appliances.

To obtain the cubic feet per hour of gas required, divide the input of the appliances by the average Btu (kWh) heating value per cubic foot of the gas. The average Btu per cubic foot in the Bay Area is 1,100.

Minimum Size of Piping Outlets. The size of the supply piping outlet for any gas appliance shall not be less than one-half (1/2) inch.

Pipe Sizing Methods. Where the piping size is to be determined using either of the methods below, the minimum diameter of each pipe segment shall be obtained from the pipe sizing shown in Table 2.

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 – 5 below)

Branch Length Method. Pipe shall be sized as follows: (See calculation example in "Figure A" and use steps 1 – 6 below)

- (A) The pipe size of each section of the longest pipe run from the meter to the most remote outlet shall be determined using the longest run of piping and the load of the section.
- (B) The pipe size of each section of branch piping not previously sized shall be determined using the length of piping from the meter to the most remote outlet in each branch and the load of the section.

Sizing of Piping Sections. To determine the size of each section of pipe in any system use Table 2, 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 Table 2, 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.

TABLE 1

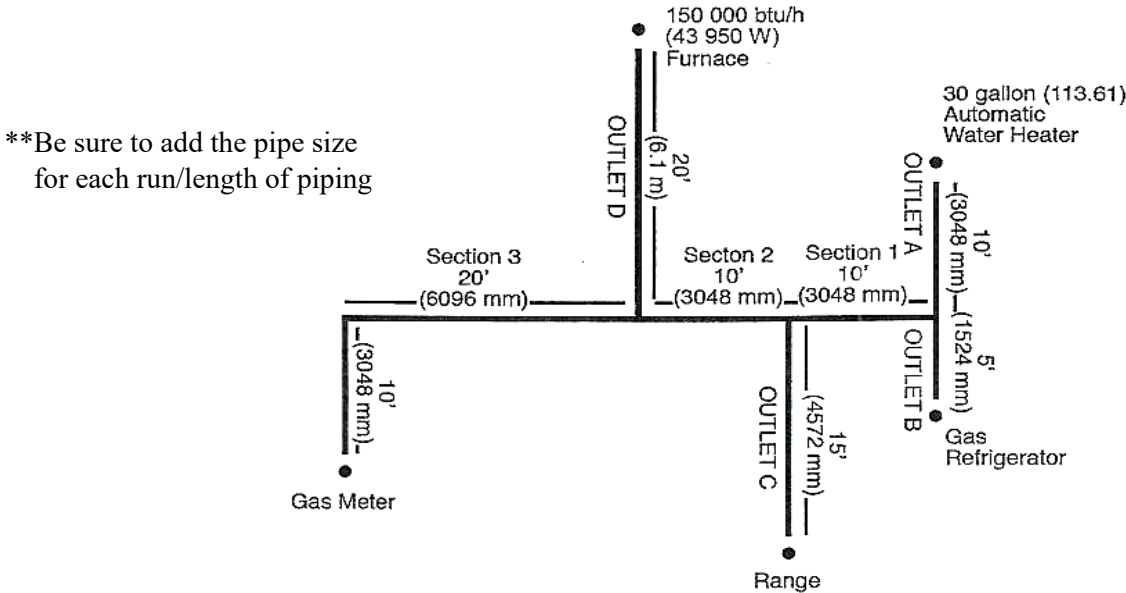
APPROXIMATE GAS INPUT FOR TYPICAL APPLIANCES

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 heaters, 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
Gaslight	2,500	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 CFM demand for all appliances
 - Maximum gas demand of outlet A:
32 cubic feet per hour (from Table 1).
 - Maximum gas demand of outlet B:
3 cubic feet per hour (from Table 1).
 - Maximum gas demand of outlet C:
59 cubic feet per hour (from Table 1).
 - Maximum gas demand of outlet D:
136 cubic feet per hour [150,000 Btu/hour divided by 1100 Btu per cubic foot].
- (2) Determine the length of pipe from the gas meter to the most remote outlet (outlet A) is 60 feet.
- (3) Using the length in feet column row marked 60 feet in Table 2:
 - 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 ¾ inch pipe.
 - Section 3, supplying outlets A, B, C, and D, or 230 cubic feet per hour, requires 1 inch pipe.
- (4) Using the column marked 60 feet in Table 2 [no column for actual length of 55 feet]:
 - Outlet B, supplying 3 cubic feet per hour, requires ½ of an inch pipe.
 - Outlet C, supplying 59 cubic feet per hour, requires ½ of an inch pipe.
- (5) Using the column marked 60 feet in Table 2:
 - Outlet D, supplying 136 cubic feet per hour, requires ¾ inch pipe.

Table 2

SCHEDULE 40 METALLIC PIPE

											GAS:			
											NATURAL			
											INLET PRESSURE:			
											LESS THAN 2 PSI			
PRESSURE DROP:		0.5 in w.c.												
SPECIFIC GRAVITY:		0.60												
PIPE SIZE (inch)														
NOMINAL:	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6	8	10	12
ACTUAL ID:	0.622	0.824	1.049	1.380	1.610	2.067	2.469	3.068	4.026	5.047	6.065	7.981	10.020	11.938
LENGTH (ft)	CAPACITY IN CUBIC FEET OF GAS PER HOUR													
10	172	360	678	1,390	2,090	4,020	6,400	11,300	23,100	41,800	67,600	139,000	252,000	399,000
20	118	247	466	957	1,430	2,760	4,400	7,780	15,900	28,700	46,500	95,500	173,000	275,000
30	95	199	374	768	1,150	2,220	3,530	6,250	12,700	23,000	37,300	76,700	139,000	220,000
40	81	170	320	657	985	1,900	3,020	5,350	10,900	19,700	31,900	65,600	119,000	189,000
50	72	151	284	583	873	1,680	2,680	4,740	9,660	17,500	28,300	58,200	106,000	167,000
60	65	137	257	528	791	1,520	2,430	4,290	8,760	15,800	25,600	52,700	95,700	152,000
70	60	126	237	486	728	1,400	2,230	3,950	8,050	14,600	23,600	48,500	88,100	139,000
80	56	117	220	452	677	1,300	2,080	3,670	7,490	13,600	22,000	45,100	81,900	130,000
90	52	110	207	424	635	1,220	1,950	3,450	7,030	12,700	20,600	42,300	76,900	122,000
100	50	104	195	400	600	1,160	1,840	3,260	6,640	12,000	19,500	40,000	72,600	115,000
125	44	92	173	355	532	1,020	1,630	2,890	5,890	10,600	17,200	35,400	64,300	102,000
150	40	83	157	322	482	928	1,480	2,610	5,330	9,650	15,600	32,100	58,300	92,300
175	37	77	144	296	443	854	1,360	2,410	4,910	8,880	14,400	29,500	53,600	84,900
200	34	71	134	275	412	794	1,270	2,240	4,560	8,260	13,400	27,500	49,900	79,000
250	30	63	119	244	366	704	1,120	1,980	4,050	7,320	11,900	24,300	44,200	70,000
300	27	57	108	221	331	638	1,020	1,800	3,670	6,630	10,700	22,100	40,100	63,400
350	25	53	99	203	305	587	935	1,650	3,370	6,100	9,880	20,300	36,900	58,400
400	23	49	92	189	283	546	870	1,540	3,140	5,680	9,190	18,900	34,300	54,300
450	22	46	86	177	266	512	816	1,440	2,940	5,330	8,620	17,700	32,200	50,900
500	21	43	82	168	251	484	771	1,360	2,780	5,030	8,150	16,700	30,400	48,100
550	20	41	78	159	239	459	732	1,290	2,640	4,780	7,740	15,900	28,900	45,700
600	19	39	74	152	228	438	699	1,240	2,520	4,560	7,380	15,200	27,500	43,600
650	18	38	71	145	218	420	669	1,180	2,410	4,360	7,070	14,500	26,400	41,800
700	17	36	68	140	209	403	643	1,140	2,320	4,190	6,790	14,000	25,300	40,100
750	17	35	66	135	202	389	619	1,090	2,230	4,040	6,540	13,400	24,400	38,600
800	16	34	63	130	195	375	598	1,060	2,160	3,900	6,320	13,000	23,600	37,300
850	16	33	61	126	189	363	579	1,020	2,090	3,780	6,110	12,600	22,800	36,100
900	15	32	59	122	183	352	561	992	2,020	3,660	5,930	12,200	22,100	35,000
950	15	31	58	118	178	342	545	963	1,960	3,550	5,760	11,800	21,500	34,000
1,000	14	30	56	115	173	333	530	937	1,910	3,460	5,600	11,500	20,900	33,100
1,100	14	28	53	109	164	316	503	890	1,810	3,280	5,320	10,900	19,800	31,400
1,200	13	27	51	104	156	301	480	849	1,730	3,130	5,070	10,400	18,900	30,000
1,300	12	26	49	100	150	289	460	813	1,660	3,000	4,860	9,980	18,100	28,700
1,400	12	25	47	96	144	277	442	781	1,590	2,880	4,670	9,590	17,400	27,600
1,500	11	24	45	93	139	267	426	752	1,530	2,780	4,500	9,240	16,800	26,600
1,600	11	23	44	89	134	258	411	727	1,480	2,680	4,340	8,920	16,200	25,600
1,700	11	22	42	86	130	250	398	703	1,430	2,590	4,200	8,630	15,700	24,800
1,800	10	22	41	84	126	242	386	682	1,390	2,520	4,070	8,370	15,200	24,100
1,900	10	21	40	81	122	235	375	662	1,350	2,440	3,960	8,130	14,800	23,400
2,000	NA	20	39	79	119	229	364	644	1,310	2,380	3,850	7,910	14,400	22,700

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm, 1 cubic foot per hour = 0.0283 m³/h, 1 pound-force per square inch = 6.8947 kPa, 1 inch water column = 0.249 kPa

Note:

¹ Table entries are rounded to 3 significant digits.

² NA means a flow of less than 10ft³/h (0.283 m³/h).