



City of Camarillo

Community Development: Building & Safety Division
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FUEL GAS PIPE SIZING & INSTALLATION with Excerpts from the 2019 CPC

Revised December 3, 2019

Code and Installation Information

The information provided in this brochure answers a number of commonly asked questions. For additional information please refer to the California Plumbing Code or speak with one of the City's Building Inspectors.

Material

All pipe used for the installation, extension, alteration, or repair of any gas piping shall be standard weight Schedule 40 wrought iron or steel (galvanized or black) or corrugated stainless steel tubing. Approved PE pipe may be used in exterior buried piping systems when installed by certified technicians.

Used Piping

Pipe shall be either new, or shall previously have been used for no other purpose than conveying gas.

Isolation of Underground Pipe

Underground ferrous gas piping shall be electrically isolated from the rest of the gas system with listed or approved isolation fittings installed a minimum of six inches above grade.

Unions

Where unions are necessary, right and left nipples and couplings shall be used. Ground joint unions may only be used at exposed fixtures, appliance, or equipment connections and in exposed exterior locations immediately on the discharge side of a building shutoff valve.

Shutoff Valves

An accessible shutoff valve shall be installed in the fuel supply piping outside of each appliance and ahead of the union connection thereto, in addition to any valve on the appliance. Shutoff valves shall be in the same room as the appliance and no further than 3 feet from the appliance.

Burial Depth

Steel pipe installed outside and underground shall have no less than 12 inches of cover. Plastic pipe shall have no less than 18 inches of cover.

Permits

A plumbing permit must be obtained prior to the installation, alteration or repair of a gas piping system.

Inspections of Underground Exterior Gas Pipe

Underground exterior gas piping requires one inspection which will occur after the pipe has been installed in a trench and pressurized but before it is covered.

Inspections of Above Ground Interior Gas Pipe: All gas piping systems within buildings shall be inspected twice.

First Inspection: (referred to as a rough inspection) occurs after the piping system has been installed but prior to it being covered or concealed, or any fixture or appliance has been attached thereto. This inspection will check for proper pipe size, material, and installation. Although not required, it is recommended that the piping system be pressurized.

Second Inspection: (referred to as a final inspection) consists of a pressure test and occurs after the building is completely enclosed but prior to connecting any equipment or appliances. For projects in which the gas piping will remain exposed, both inspections would be combined into a single inspection.

Pressure Tests

All gas piping systems will be pressure tested at least once during the inspection process. It is the responsibility of the permit holder to provide and install a temporary pressure gauge and to pressurize the piping system. All gas piping systems shall be pressurized using air, CO2, or nitrogen. For most residential installations the gas piping system shall be pressurized to no less than ten (10) psi and shall hold that pressure for no less than 15 minutes. The gauge used for the pressure test shall have a pressure range not greater than twice the test pressure applied and shall have 1/10 psi incrementation.

Sizing Gas Pipe

Gas pipe needs to be sized correctly. You can size the gas pipe by following the example in this handout or you may request assistance from a Building Inspector. For the Building Inspector to help, you must provide a piping layout (similar to Figure “C”) with the lengths of all piping and the input demand load of all appliances shown on the drawing. Sizing the pipe will depend on the type of pipe being used.

CPC Table 1208.4.1		
Appliance	INPUT (btu/h approx.)	CF/H
Space Heating Units		
Warm air furnace		
Single Family	100,000	91
Multi-family, per unit	60,000	55
Hydronic boiler		
Single Family	100,000	91
Multi-family, per unit	60,000	55
Space and Water Heating Units		
Single Family	120,000	109
Multi-family, per unit	75,000	68
Water Heating Appliances		
Water heater, automatic storage		
30-40 gallon tank	35,000	32
Water heater, automatic storage		
50 gallon tank	50,000	45
Water heater, automatic instantaneous		
Capacity at 2 gallons per minute	142,800	130
Capacity at 4 gallons per minute	285,000	259
Capacity at 6 gallons per minute	428,400	389
Water heater, domestic, circulating or side-arm		
	35,000	32
Cooking Appliances		
Range, freestanding, domestic		
	65,000	59
Built-in oven or broiler unit, domestic		
	25,000	23
Built-in top unit, domestic		
	40,000	36
Other appliances		
Refrigerator		
	3,000	3
Clothes dryer, Type I (domestic)		
	35,000	32
Gas fireplace direct vent		
	40,000	36
gas log		
	80,000	73
Barbecue		
	40,000	36
Gaslight		
	2,500	2

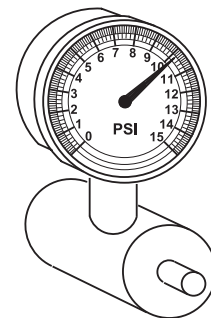


Figure B
For pressure testing gas lines use a 15 lb. gauge with 1/10 lb. increments

Note 1 The demand ratings of the appliances listed in this table are minimums. Demand ratings of the actual installed appliances may be higher. Refer to name plate rating on appliance—use the input Btu/h number. The tables used to size gas piping are based on Cubic Feet per Hour (CFH). To determine the CFH divide the input of the appliances by the average Btu per cubic foot. Contact your local gas supplier to obtain the Btu per cubic foot in your area.

Example exercise for sizing gas pipe

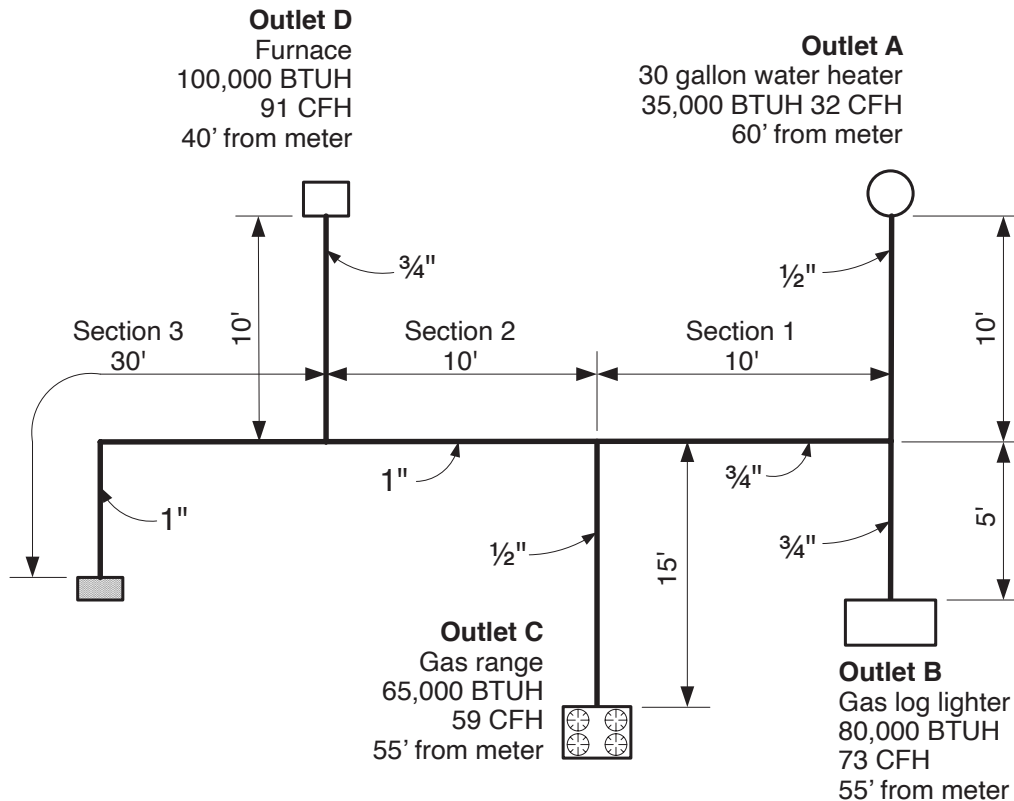


Figure C
Example Piping Layout and Appliance Demand

Example for Determining Pipe Sizes

Problem:

The local utility can deliver 1,100 Btu per cubic feet. Determine the required pipe size of each section and outlet of the piping system shown in Figure "C". To figure the CFH (cubic feet per hour) of natural gas, divide the Btu/h (British thermal units per hour) input rating of an appliance by 1,100. The type of pipe used will be Schedule 40 Metallic (Table 1215.2(1)).

Solution:

- Determine the maximum input gas demand for each appliance by using Table 1208.4.1 or from the actual name plate of the appliance whichever is higher.
- Determine the length of pipe from the gas meter to each outlet. If the length falls between those lengths shown on appropriate gas size piping table then go to the next higher column.
- Figure the lateral pipe sizes feeding the individual appliances
 - Outlet A – Use 60' column – with a demand load of 32 CFH the minimum pipe size is 1/2"
 - Outlet B – Use 60' column – with a demand load of 73 CFH the minimum pipe size is 3/4"
 - Outlet C – Use 60' column – with a demand load of 59 CFH the minimum pipe size is 1/2"
 - Outlet D – Use 40' column – with a demand load of 91 CFH the minimum pipe size is 3/4"
- Figure the size of the main pipe which is feeding more than one appliance. Select the most remote outlet in the system which is Outlet A. It is 60' from the meter so use the 60' column. Then determine the various pipes sizes based upon the demand loads in each section of pipe.
 - Section 1 – Serves Outlets A and B with a total demand load of 105 CFH – minimum pipe size is 3/4"
 - Section 2 – Serves Outlets A, B and C with a total demand load of 164 CFH – minimum pipe size is 1"

The following tables are excerpts from the 2019 California Plumbing Code. The proposed gas pipe type and pressures may vary. Contact your local Gas utility company to determine the correct pressures. Additional tables are found in the Plumbing Code

TABLE 1215.2(1)
SCHEDULE 40 METALLIC PIPE [NFPA 54: TABLE 6.2(b)]^{1,2}



														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	1.310	1.610	2.067	2.469	3.068	4.026	5.047	6.046	7.981	10.020	11.938													
LENGTH (feet)	CAPACITY IN CUBIC FEET OF GAS PER HOUR																										
10	172	360	678	1390	2090	4020	6400	11300	23100	41800	67600	139000	252000	399000													
20	118	247	466	957	1430	2760	4400	7780	15900	28700	46500	95500	173000	275000													
30	95	199	374	768	1150	2230	3530	6250	12700	23000	37300	76700	139000	220000													
40	81	170	320	657	985	1900	3020	5350	10900	19700	31900	65600	119000	189000													
50	72	151	284	583	873	1680	2680	4740	9660	17500	28300	58200	106000	167000													
60	65	137	257	528	791	1520	2430	4290	8760	15800	25600	52700	95700	152000													
70	60	126	237	486	728	1400	2230	3950	8050	14600	23600	48500	88100	139000													
80	56	117	220	452	677	1300	2080	3670	7490	13600	22000	45100	81900	130000													
90	52	110	207	424	635	1220	1950	3450	7030	12700	20600	42300	76900	122000													
100	50	104	195	400	600	1160	1840	3260	6640	12000	19500	40000	72600	115000													
125	44	92	173	355	532	1020	1630	2890	5890	10600	17200	35400	64300	102000													
150	40	83	157	322	482	928	1480	2610	5330	9650	15600	32100	58300	92300													
175	37	77	144	296	443	854	1360	2410	4910	8880	14400	29500	53600	84900													
200	34	71	134	275	412	794	1270	2240	4560	8260	13400	27500	49900	79000													
250	30	63	119	244	366	704	1120	1980	4050	7320	11900	24300	44200	70000													
300	27	57	108	221	331	638	1020	1800	3670	6630	10700	22100	40100	63400													
350	25	53	99	203	305	587	935	1650	3370	6100	9880	20300	36900	58400													
400	23	49	92	189	283	546	870	1540	3140	5680	9190	18900	34300	54300													
450	22	46	86	177	266	512	816	1440	2940	5330	8620	17700	32200	50900													
500	21	43	82	168	251	484	771	1360	2780	5030	8150	16700	30400	48100													
550	20	41	78	159	239	459	732	1290	2640	4780	7740	15900	28900	45700													
600	19	39	74	152	228	438	699	1240	2520	4560	7380	15200	27500	43600													
650	18	38	71	145	218	420	669	1180	2410	4360	7070	14500	26400	41800													
700	17	36	68	140	209	403	643	1140	2320	4190	6790	14000	25300	40100													
750	17	35	66	135	202	389	619	1090	2230	4040	6540	13400	24400	38600													
800	16	34	63	130	195	375	598	1060	2160	3900	6320	13000	23600	37300													
850	16	33	61	126	189	363	579	1020	2090	3780	6110	12600	22800	36100													
900	15	32	59	122	183	352	561	992	2020	3660	5930	12200	22100	35000													
950	15	31	58	118	178	342	545	963	1960	3550	5760	11800	21500	34000													
1000	14	30	56	115	173	333	530	937	1910	3460	5600	11500	20900	33100													
1100	14	28	53	109	164	316	503	890	1810	3280	5320	10900	19800	31400													
1200	13	27	51	104	156	301	480	849	1730	3130	5070	10400	18900	30000													
1300	12	26	49	100	150	289	460	813	1660	3000	4860	9980	18100	28700													
1400	12	25	47	96	144	277	442	781	1590	2880	4670	9590	17400	27600													
1500	11	24	45	93	139	267	426	752	1530	2780	4500	9240	16800	26600													
1600	11	23	44	89	134	258	411	727	1480	2680	4340	8920	16200	25600													
1700	11	22	42	86	130	250	398	703	1430	2590	4200	8650	15700	24800													
1800	10	22	41	84	126	242	386	682	1390	2520	4070	8370	15200	24100													
1900	10	21	40	81	122	235	375	662	1350	2440	3960	8130	14800	23400													
2000	NA	20	39	79	119	229	364	644	1310	2380	3850	7910	14400	22700													

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

Notes:

¹ Table entries are rounded to 3 significant digits.

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

» TABLE 1215.2(14)
CORRUGATED STAINLESS STEEL TUBING (CSST) [NFPA 54: TABLE 6.2(o)]^{1,2}

		GAS: NATURAL													
		INLET PRESSURE: LESS THAN 2 psi													
		PRESSURE DROP: 0.5 in. w.c.													
		SPECIFIC GRAVITY: 0.60													
		TUBE SIZE (EHD) ³													
FLOW DESIGNATION:		13	15	18	19	23	25	30	31	37	39	46	48	60	62
LENGTH (feet)		CAPACITY IN CUBIC FEET OF GAS PER HOUR													
5		46	63	115	134	225	270	471	546	895	1037	1790	2070	3660	4140
10		32	44	82	95	161	192	330	383	639	746	1260	1470	2600	2930
15		25	35	66	77	132	157	267	310	524	615	1030	1200	2140	2400
20		22	31	58	67	116	137	231	269	456	536	888	1050	1850	2080
25		19	27	52	60	104	122	206	240	409	482	793	936	1660	1860
30		18	25	47	55	96	112	188	218	374	442	723	856	1520	1700
40		15	21	41	47	83	97	162	188	325	386	625	742	1320	1470
50		13	19	37	42	75	87	144	168	292	347	559	665	1180	1320
60		12	17	34	38	68	80	131	153	267	318	509	608	1080	1200
70		11	16	31	36	63	74	121	141	248	295	471	563	1000	1110
80		10	15	29	33	60	69	113	132	232	277	440	527	940	1040
90		10	14	28	32	57	65	107	125	219	262	415	498	887	983
100		9	13	26	30	54	62	101	118	208	249	393	472	843	933
150		7	10	20	23	42	48	78	91	171	205	320	387	691	762
200		6	9	18	21	38	44	71	82	148	179	277	336	600	661
250		5	8	16	19	34	39	63	74	133	161	247	301	538	591
300		5	7	15	17	32	36	57	67	95	118	226	275	492	540

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

Notes:

¹ Table entries are rounded to 3 significant digits.

² Table includes losses for four 90 degree (1.57 rad) bends and two end fittings. Tubing runs with larger numbers of bends, fittings, or both shall be increased by an equivalent length of tubing to the following equation: $L = 1.3n$, where L is additional length (ft) of tubing and n is the number of additional fittings, bends, or both.

³ EHD = Equivalent Hydraulic Diameter, which is a measure of the relative hydraulic efficiency between different tubing sizes. The greater the value of EHD, the greater the gas capacity of the tubing.

» TABLE 1215.2(20)
POLYETHYLENE PLASTIC PIPE [NFPA 54: TABLE 6.2(u)]*

		GAS: NATURAL							
		INLET PRESSURE: LESS THAN 2 psi							
		PRESSURE DROP: 0.5 in. w.c.							
		SPECIFIC GRAVITY: 0.60							
		PIPE SIZE (Inch)							
NOMINAL OD:		½	¾	1	1 ¼	1 ½	2	3	4
DESIGNATION:		SDR 9.3	SDR 11	SDR 11	SDR 10	SDR 11	SDR 11	SDR 11	SDR 11
ACTUAL ID:		0.880	0.880	1.077	1.328	1.554	1.943	2.884	3.882
LENGTH (feet)		CAPACITY IN CUBIC FEET OF GAS PER HOUR							
10		201	403	726	1260	1900	3410	9450	18 260
20		138	277	499	865	1310	2350	6490	12 550
30		111	222	401	695	1050	1880	5210	10 080
40		95	190	343	594	898	1610	4460	8630
50		84	169	304	527	796	1430	3950	7640
60		76	153	276	477	721	1300	3580	6930
70		70	140	254	439	663	1190	3300	6370
80		65	131	236	409	617	1110	3070	5930
90		61	123	221	383	579	1040	2880	5560
100		58	116	209	362	547	983	2720	5250
125		51	103	185	321	485	871	2410	4660
150		46	93	168	291	439	789	2180	4220
175		43	86	154	268	404	726	2010	3880
200		40	80	144	249	376	675	1870	3610
250		35	71	127	221	333	598	1660	3200
300		32	64	115	200	302	542	1500	2900
350		29	59	106	184	278	499	1380	2670
400		27	55	99	171	258	464	1280	2480
450		26	51	93	160	242	435	1200	2330
500		24	48	88	152	229	411	1140	2200

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

* Table entries are rounded to 3 significant digits.