# FUEL GAS LINE DIAGRAM REQUIREMENTS

## CPC §1208.4 & 1215

All permit applications for fuel gas plumbing installation and replacement shall be accompanied by a schematic diagram of the existing and proposed gas plumbing system. Sizing of the fuel gas piping shall be in accordance with Sections 1208.4 and 1215 of the 2022 California Plumbing Code, as described in this publication. Include the following information on an 8½ x 11 sheet. This page may be used for preparing that diagram.

**Project Address:**

**Project Scope:**

**Applicable Codes:** *2022 California Plumbing Code & 2022 California Mechanical Code, as applies.*

**Type of Piping Material(s) Used:**

**Pipe Sizing Table Used:**
*(e.g., 1215.2(1) for sched 40 metallic, 1215.2(14) for CSST, 1215.2(19) for poly*):

**Gas Appliances and BTU/H Input Ratings:**
*(or note on gas line diagram)*

**GAS LINE DIAGRAM** (provide below)

- Diagram does not need to be to-scale; however, it shall be clear and legible.
- List size of pipe per leg. List type of pipe per leg if different materials are used.
- Show "(E)" for existing appliances and "(N)" for new
- Attach specific manufacture sizing table used if different from CPC or CMC tables.

NAME OF PERSON DRAWING DIAGRAM

SIGNATURE OF PERSON DRAWING DIAGRAM

DEPARTMENT OF PLANNING & COMMUNITY DEVELOPMENT • BUILDING & SAFETY DIVISION

809 Center Street • Room 101
Santa Cruz, CA 95060
831.420.5120 • Fax: 831.420.5434
**cityofsantacruz.com/building**

Lee Butler, Director of Planning & Community Development
John Gervasoni, Chief Building Official

## 1208.4 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.

**1208.4.1 Maximum Gas Demand.** The volumetric flow rate of gas to be provided (in cubic feet per hour) shall be calculated using the manufacturer's input ratings of the appliance served, adjusted for altitude. Where the input rating is not indicated, the gas supplier, appliance manufacturer, or a qualified agency shall be contacted or the rating from **Table 1208.4.1** shall be used for estimating the volumetric flow rate of gas to be supplied.

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

**TABLE 1208.4.1**
**APPROXIMATE GAS INPUT FOR TYPICAL APPLIANCES**
**[NFPA 54: TABLE 5.4.2.1]**

| APPLIANCE | INPUT (Btu/h approx.) |
|---|---|
| **Space Heating Units** | |
| Warm air furnace | |
| Single family | 100 000 |
| Multifamily, per unit | 60 000 |
| Hydronic boiler | |
| Single family | 100 000 |
| Multifamily, per unit | 60 000 |
| **Space and Water Heating Units** | |
| Hydronic boiler | |
| Single family | 120 000 |
| Multifamily, per unit | 75 000 |
| **Water Heating Appliances** | |
| Water heater, automatic storage 30 to 40 gallon tank | 35 000 |
| Water heater, automatic storage 50 gallon tank | 50 000 |
| Water heater, automatic instantaneous | |
| Capacity at 2 gallons per minute | 142 800 |
| Capacity at 4 gallons per minute | 285 000 |
| Capacity at 6 gallons per minute | 428 400 |
| Water heater, domestic, circulating or side-arm | 35 000 |
| **Cooking Appliances** | |
| Range, freestanding, domestic | 65 000 |
| Built-in oven or broiler unit, domestic | 25 000 |
| Built-in top unit, domestic | 40 000 |
| **Other Appliances** | |
| Refrigerator | 3000 |
| Clothes dryer, Type 1 (domestic) | 35 000 |
| Gas fireplace direct vent | 40 000 |
| Gas log | 80 000 |
| Barbecue | 40 000 |
| Gaslight | 2500 |

For SI units: 1000 British thermal units per hour = 0.293 kW

## 1215.0 Required Gas Piping Size.

**1215.1 Pipe Sizing Methods.** Where the pipe size is to be determined using a method in Section 1215.1.1 through Section 1215.1.3, the diameter of each pipe segment shall be ob-tained from the pipe sizing tables in Section 1215.2 or from the sizing equations in Section 1215.3.

**1215.1.1 Longest Length Method.** The pipe size of each section of gas piping shall be determined using the longest length of piping from the point of delivery to the most remote outlet and the load of the section (see calculation example in Figure 1215.1.1).

**1215.1.2 Branch Length Method.** Pipe shall be sized as follows:

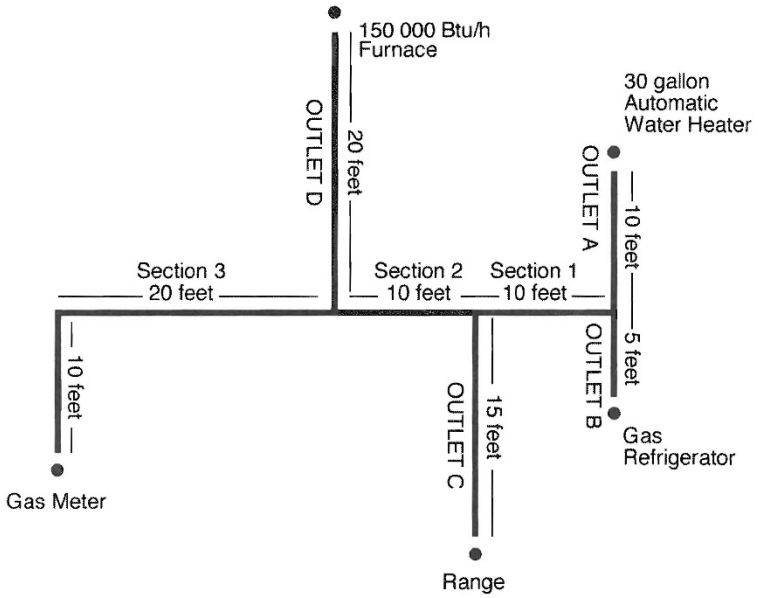
The pipe size of each section of the longest pipe run from the point of delivery to the most remote outlet shall be determined using the longest run of piping and the load of the section.

The pipe size of each section of branch piping not previously sized shall be determined using the length of piping from the point of delivery to the most remote outlet in each branch and the load of the section.

## FIGURE 1215.1.1

EXAMPLE ILLUSTRATING USE OF TABLE 1208-4.1 AND TABLE 1215.2(1)

**Problem:** Determine the required pipe size of each section and outlet of the piping system shown in Figure 1215.1.1. Gas to be used has a specific gravity of 0.60 and 1,100 British thermal units (Btu) per cubic foot, delivered at 8-inch water column pressure.




## Solution:

(1) Maximum gas demand of **Outlet A**: 32 cubic feet per hour (from Table 1208.4.1).
Maximum gas demand of **Outlet B**: 3 cubic feet per hour (from Table 1208.4.1).
Maximum gas demand of **Outlet C**: 59 cubic feet per hour (from Table 1208.4.1).
Maximum gas demand of **Outlet D**: 136 cubic feet per hour [150,000 Btu/hour divided by 1,100 Btu per cubic foot].

(2) 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 1215.2(1)**:
**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 1215.2(1)** [*no column for actual length of 55 feet*]:
**Outlet B** supplying 3 cubic feet per hour, requires ½-inch pipe.
**Outlet C**, supplying 59 cubic feet per hour, requires ½-inch pipe.

(5) Using the column marked *60 feet* in **Table 1215.2(1)**:
**Outlet D**, supplying 136 cubic feet per hour, requires ¾-inch pipe.

## Example #2 – Trunk and Branch Line Sizing

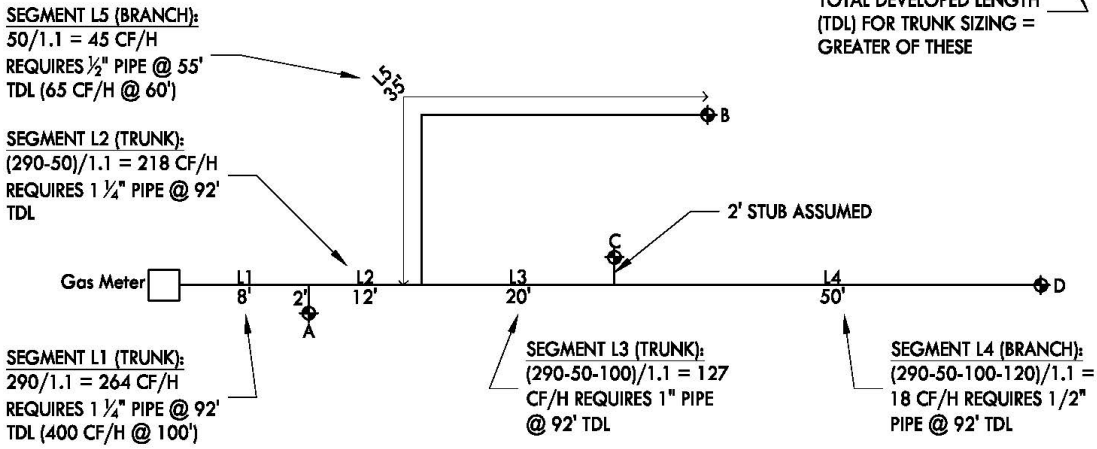
To clarify the differences between trunk line sizing and branch sizing, below is an example showing the use of the:

- Longest Length Method (for trunks) and
- Branch Length Method (for branches)

as used when sizing fuel gas piping. Your system will have different appliances, input rates and piping configuration.

**GAS PIPING CALCULATIONS**

| OUTPUT # | APPLIANCE NAME | APPLIANCE INPUT [KBTU/H] | TRUNK PIPE SIZING DEVELOPED LENGTH |
|---|---|---|---|
| A | WATER HEATER | 50 | L1+2 = 10 |
| B | RANGE | 100 | L1+L2+L5 = 55 |
| C | FAU | 120 | L1+L2+L3+2 = 42 |
| D | FIREPIT | 20 | L1+L2+L3+L4 = 92 |
| | TOTAL | 290 /[1.1 CF/KBTU] = 264 CF/H | |




Outlet D is the furthest from the point of delivery (gas meter) with a TDL of 92 feet. All sections of pipe running from the gas meter to the most remote outlet (i.e., the trunk) are sized based on a developed length of 92 feet. Branches are sized based on the distance from meter to the furthest outlet on the branch, as is shown for the design of segment L5.

## Example Fuel Gas Piping Size Table:

**Table applies for Schedule 40 Metallic Pipe only.** Refer to the current edition of the CA Plumbing Code for other pipe materials.

**TABLE 1215.2(1)**
**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: | ½ | ¾ | 1 | 1¼ | 1½ | 2 | 2½ | 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 (feet) | CAPACITY IN CUBIC FEET OF GAS PER HOUR | | | | | | | | | | | | | |
| 10 | 172 | 360 | 678 | 1390 | 2090 | 4020 | 6400 | 11 300 | 23 100 | 41 800 | 67 600 | 139 000 | 252 000 | 399 000 |
| 20 | 118 | 247 | 466 | 957 | 1430 | 2760 | 4400 | 7780 | 15 900 | 28 700 | 46 500 | 95 500 | 173 000 | 275 000 |
| 30 | 95 | 199 | 374 | 768 | 1150 | 2220 | 3530 | 6250 | 12 700 | 23 000 | 37 300 | 76 700 | 139 000 | 220 000 |
| 40 | 81 | 170 | 320 | 657 | 985 | 1900 | 3020 | 5350 | 10 900 | 19 700 | 31 900 | 65 600 | 119 000 | 189 000 |
| 50 | 72 | 151 | 284 | 583 | 873 | 1680 | 2680 | 4740 | 9660 | 17 500 | 28 300 | 58 200 | 106 000 | 167 000 |
| 60 | 65 | 137 | 257 | 528 | 791 | 1520 | 2430 | 4290 | 8760 | 15 800 | 25 600 | 52 700 | 95 700 | 152 000 |
| 70 | 60 | 126 | 237 | 486 | 728 | 1400 | 2230 | 3950 | 8050 | 14 600 | 23 600 | 48 500 | 88 100 | 139 000 |
| 80 | 56 | 117 | 220 | 452 | 677 | 1300 | 2080 | 3670 | 7490 | 13 600 | 22 000 | 45 100 | 81 900 | 130 000 |
| 90 | 52 | 110 | 207 | 424 | 635 | 1220 | 1950 | 3450 | 7030 | 12 700 | 20 600 | 42 300 | 76 900 | 122 000 |
| 100 | 50 | 104 | 195 | 400 | 600 | 1160 | 1840 | 3260 | 6640 | 12 000 | 19 500 | 40 000 | 72 600 | 115 000 |
| 125 | 44 | 92 | 173 | 355 | 532 | 1020 | 1630 | 2890 | 5890 | 10 600 | 17 200 | 35 400 | 64 300 | 102 000 |
| 150 | 40 | 83 | 157 | 322 | 482 | 928 | 1480 | 2610 | 5330 | 9650 | 15 600 | 32 100 | 58 300 | 92 300 |
| 175 | 37 | 77 | 144 | 296 | 443 | 854 | 1360 | 2410 | 4910 | 8880 | 14 400 | 29 500 | 53 600 | 84 900 |
| 200 | 34 | 71 | 134 | 275 | 412 | 794 | 1270 | 2240 | 4560 | 8260 | 13 400 | 27 500 | 49 900 | 79 000 |
| 250 | 30 | 63 | 119 | 244 | 366 | 704 | 1120 | 1980 | 4050 | 7320 | 11 900 | 24 300 | 44 200 | 70 000 |
| 300 | 27 | 57 | 108 | 221 | 331 | 638 | 1020 | 1800 | 3670 | 6630 | 10 700 | 22 100 | 40 100 | 63 400 |
| 350 | 25 | 53 | 99 | 203 | 305 | 587 | 935 | 1650 | 3370 | 6100 | 9880 | 20 300 | 36 900 | 58 400 |
| 400 | 23 | 49 | 92 | 189 | 283 | 546 | 870 | 1540 | 3140 | 5680 | 9190 | 18 900 | 34 300 | 54 300 |
| 450 | 22 | 46 | 86 | 177 | 266 | 512 | 816 | 1440 | 2940 | 5330 | 8620 | 17 700 | 32 200 | 50 900 |
| 500 | 21 | 43 | 82 | 168 | 251 | 484 | 771 | 1360 | 2780 | 5030 | 8150 | 16 700 | 30 400 | 48 100 |
| 550 | 20 | 41 | 78 | 159 | 239 | 459 | 732 | 1290 | 2640 | 4780 | 7740 | 15 900 | 28 900 | 45 700 |
| 600 | 19 | 39 | 74 | 152 | 228 | 438 | 699 | 1240 | 2520 | 4560 | 7380 | 15 200 | 27 500 | 43 600 |
| 650 | 18 | 38 | 71 | 145 | 218 | 420 | 669 | 1180 | 2410 | 4360 | 7070 | 14 500 | 26 400 | 41 800 |
| 700 | 17 | 36 | 68 | 140 | 209 | 403 | 643 | 1140 | 2320 | 4190 | 6790 | 14 000 | 25 300 | 40 100 |
| 750 | 17 | 35 | 66 | 135 | 202 | 389 | 619 | 1090 | 2230 | 4040 | 6540 | 13 400 | 24 400 | 38 600 |
| 800 | 16 | 34 | 63 | 130 | 195 | 375 | 598 | 1060 | 2160 | 3900 | 6320 | 13 000 | 23 600 | 37 300 |
| 850 | 16 | 33 | 61 | 126 | 189 | 363 | 579 | 1020 | 2090 | 3780 | 6110 | 12 600 | 22 800 | 36 100 |
| 900 | 15 | 32 | 59 | 122 | 183 | 352 | 561 | 992 | 2020 | 3660 | 5930 | 12 200 | 22 100 | 35 000 |
| 950 | 15 | 31 | 58 | 118 | 178 | 342 | 545 | 963 | 1960 | 3550 | 5760 | 11 800 | 21 500 | 34 000 |
| 1000 | 14 | 30 | 56 | 115 | 173 | 333 | 530 | 937 | 1910 | 3460 | 5600 | 11 500 | 20 900 | 33 100 |
| 1100 | 14 | 28 | 53 | 109 | 164 | 316 | 503 | 890 | 1810 | 3280 | 5320 | 10 900 | 19 800 | 31 400 |
| 1200 | 13 | 27 | 51 | 104 | 156 | 301 | 480 | 849 | 1730 | 3130 | 5070 | 10 400 | 18 900 | 30 000 |
| 1300 | 12 | 26 | 49 | 100 | 150 | 289 | 460 | 813 | 1660 | 3000 | 4860 | 9980 | 18 100 | 28 700 |
| 1400 | 12 | 25 | 47 | 96 | 144 | 277 | 442 | 781 | 1590 | 2880 | 4670 | 9590 | 17 400 | 27 600 |
| 1500 | 11 | 24 | 45 | 93 | 139 | 267 | 426 | 752 | 1530 | 2780 | 4500 | 9240 | 16 800 | 26 600 |
| 1600 | 11 | 23 | 44 | 89 | 134 | 258 | 411 | 727 | 1480 | 2680 | 4340 | 8920 | 16 200 | 25 600 |
| 1700 | 11 | 22 | 42 | 86 | 130 | 250 | 398 | 703 | 1430 | 2590 | 4200 | 8630 | 15 700 | 24 800 |
| 1800 | 10 | 22 | 41 | 84 | 126 | 242 | 386 | 682 | 1390 | 2520 | 4070 | 8370 | 15 200 | 24 100 |
| 1900 | 10 | 21 | 40 | 81 | 122 | 235 | 375 | 662 | 1350 | 2440 | 3960 | 8130 | 14 800 | 23 400 |
| 2000 | NA | 20 | 39 | 79 | 119 | 229 | 364 | 644 | 1310 | 2380 | 3850 | 7910 | 14 400 | 22 700 |

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm, 1 cubic foot per hour = 0.0283 $m^3/h$, 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 $ft^3/h$ (0.283 $m^3/h$).