

the sizing Equations 12-1 or 12-2, using the equivalent pipe length determined by Sections 1216.1.1 through 1216.1.3. [NFPA 54:6.4]

Equation 12-1 Low-Pressure Gas Formula (Less than 10.3kPa [1.5 psi]) [NFPA 54:6.4.1]:

$$D = \frac{Q^{0.381}}{19.17 \left(\frac{\Delta H}{Cr \times L} \right)^{0.206}}$$

Where:

D = inside diameter of pipe, mm

Q = input rate appliance(s), m³/h (ft.³/h) at 16°C (61°F) and 76cm (30 in.) mercury column

P₁ = upstream pressure, kPa

P₂ = downstream pressure, kPa

L = equivalent length of pipe, m

ΔH = pressure drop, mm water column (704mm [27.7 in.] H₂O = 6.9kPa [1 psi])

Equation 12-2 High-Pressure Gas Formula (10.3kPa [1.5 psi] and above) [NFPA 54:6.4.2]:

$$D = \frac{Q^{0.381}}{18.93 \left[\frac{(P_1^2 - P_2^2) \cdot Y}{Cr \times L} \right]^{0.206}}$$

Where:

D = inside diameter of pipe, mm

Q = input rate appliance(s), m³/h (ft.³/h) at 16°C (61°F) and 76cm (30 in.) mercury column

P₁ = upstream pressure, kPa

P₂ = downstream pressure, kPa

L = equivalent length of pipe, m.

ΔH = pressure drop, inches water column (704mm [27.7 in.] H₂O = 6.9kPa [1 psi])

TABLE 12-6

Cr and Y for Natural Gas and Undiluted Propane at Standard Conditions [NFPA 54: Table 6.4.2]

Formula Factors Gas	Cr	Y
Natural Gas	0.6094	0.9992
Undiluted Propane	1.2462	0.9910

SI: 1m³ = 35.3 ft.³; 1m = 3.3 ft.;

1kPa = 4.0 in. water column;

1kPa = 0.15 psi; 1kW = 3.4 Btu

1216.4 To determine the size of each section of pipe in any system within the range of the table proceed as follows:

- (A) Measure the length of the pipe from the gas meter location to the most remote outlet on the system.
- (B) Select the length in feet column and row showing that distance, or the next longer distance if the table does not give the exact length.
- (C) Starting at the most remote outlet, find in the row just selected the gas demand for that outlet. If the exact figure of demand is not shown, choose the next larger figure in the row.
- (D) At the top of this column will be found the correct size of pipe.
- (E) 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. Where gas piping sections serve both heating and cooling appliances and the installation prevents both units from operating simultaneously, only the larger of the two demand loads needs be used in sizing these sections.
- (F) 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 B, C, D, and E above.

Note: Size branch piping in the order of their distance from the meter location, beginning with the most distant outlet not previously sized.

1216.5 For conditions other than those covered by Section 1216.1, such as longer runs or greater gas demands, the size of each gas piping system shall be determined by standard engineering methods acceptable to the Authority Having Jurisdiction, and each such system shall be so designed that the total pressure drop between the meter or other point of supply and any outlet when full demand is being supplied to all outlets, shall comply with the requirements of Section 1208.4.

1216.6 Where the gas pressure exceeds 36cm (14 in.) or less than 15cm (6 in.) of water column, or when diversity demand factors are used, the design, pipe, sizing, materials, location, and use of such systems first shall be approved by the Authority Having Jurisdiction. Piping systems designed for pressures exceeding the serving gas supplier's standard delivery pressure shall have prior verification from the gas supplier of the availability of the design pressure.