Public Comment No. 3-NFPA 54-2022 [Section No. 1.1.1.2]

1.1.1.2

This code shall not apply to the following items:

(1) Portable LP-Gas appliances and equipment of all types that are not connected to a fixed fuel piping system

(2) Installation of appliances such as brooders, dehydrators, dryers, and irrigation equipment used for agricultural purposes

(3) Raw material (feedstock) applications except for piping to special atmosphere generators

(4) Oxygen–fuel gas cutting and welding systems

(5) Industrial gas applications using such gases as acetylene and acetylenic compounds, hydrogen, ammonia, carbon monoxide, oxygen, and nitrogen

(6) Petroleum refineries, pipeline compressor or pumping stations, loading terminals, compounding plants, refinery tank farms, and natural gas processing plants

(7) Large integrated chemical plants or portions of such plants where flammable or combustible liquids or gases are produced by chemical reactions or used in chemical reactions

(8) LP-Gas installations at utility gas plants

(9) Liquefied natural gas (LNG) ~~installations~~ installations other than fuel gas systems within the scope of NFPA 54

(10) Fuel gas piping in electric utility power plants

(11) Proprietary items of equipment, apparatus, or instruments such as gas generating sets, compressors, and calorimeters

(12) LP-Gas equipment for vaporization, gas mixing, and gas manufacturing

(13) LP-Gas piping for buildings under construction or renovations that is not to become part of the permanent building piping system — that is, temporary fixed piping for building heat

(14) Installation of LP-Gas systems for railroad switch heating

(15) Installation of LP-Gas and compressed natural gas (CNG) systems on vehicles

(16) Gas piping, meters, gas pressure regulators, and other appurtenances used by the serving gas supplier in distribution of gas, other than undiluted LP-Gas

(17) Building design and construction, except as specified herein

(18) Fuel gas systems on recreational vehicles manufactured in accordance with NFPA 1192

(19) Fuel gas systems using hydrogen as a fuel

(20) Construction of appliances

Statement of Problem and Substantiation for Public Comment

This comments attempts to coordinate the requirements of low pressure, non-liquefied, natural gas in LNG facilities. This need was brought to my attention by members of the NFPA 59A committee to exempt non-liquefied natural gas in LNG facilities from the exemption of NFPA 54 at LNG facilities

The committee rejected this recommendation in PI 23 stating, “The maintenance of appliances is

covered within the code. Fuel gas appliances in LNG plants are under NFPA 54 where they fall into the scope of NFPA 54 and is the proposed text is unnecessary".

This ignores the fact that NPFA excludes in 1.1.1.2 (9) LNG installations, which is reasonably interpreted by many code users to mean the entire LNG installation, including all natural gas in the vapor state, including low pressure uses, such as heating buildings and cooking. This clarification is needed to provide requirements for gas appliances and related piping in LNG plants. NFPA 59A provides no such requirements.

Related Item

• PI 23

Submitter Information Verification

Submitter Full Name: Theodore Lemoff
Organization: TLemoff Engineering
Affiliation: None
Street Address:
City:
State:
Zip:
Submittal Date: Fri Apr 01 13:27:13 EDT 2022
Committee: NFG-AAA

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-20-NFPA 54-2022
Statement: LNG Installation refers to everything inside the fence line of an LNG facility while systems covers the LNG process systems (liquefaction, regasification, etc.) and permits the use of NFPA 54 for design of systems typically designed under NFPA 54.

Public Comment No. 40-NFPA 54-2022 [New Section after 2.3.3]

2.3.4 ISO Publications

ISO 17484-1, Multilayer pipe systems for indoor gas installations with a maximum operating pressure up to and including 5 bar (500 kPa) - Part 1: Specifications for systems.

2.3. 4 5 MSS Publications.

2.3. ~~5~~ 6 UL Publications.

2.3. ~~6~~ 7 US Government Publications.

2.3. ~~7~~ 8 Other Publications.

Statement of Problem and Substantiation for Public Comment

PEX-AL-PEX has been used for gas service and distribution for over 15 years under numerous ISO, EU, and Australian standards. ISO 17484-1 includes allowance for use with gases that are compatible with the pipe and fittings. Based on committee feedback from the first draft meeting, we are referencing ISO 17484-1.

Related Item

• Public Input No. 87-NFPA 54-2021

Submitter Information Verification

Submitter Full Name: Andrew Klein
Organization: A S Klein Engineering, PLLC
Affiliation: Ferguson Enterprises
Street Address:
City:
State:
Zip:
Submittal Date: Mon May 30 22:51:13 EDT 2022
Committee: NFG-AAA

Committee Statement

Committee Action: Rejected

Resolution: Public Comments 41, 44, 45 The proposed composite tubing product (PEX-AL-PEX) as presented does not have a fire resistance that matches other similar metallic piping products that are currently recognized in Section 5.5 of the NFPA 54. The proposed PEX-AL-PEX fitting do not meet ANSI LC 4 for press-to-connect fittings (which requires 1000F). Brazing also requires a high temperature fitting (1000F). The ISO 17484-1 Standard proposed for the material does not include fire resistance requirements, and the proposed requirements do not require additional fire protection methods such as excess flow valves or external fire protection (installation behind gypsum walls). The requirement language did not require the listing to the ISO 17484-1 rather compliance to the standard. Public Comments 40, 42, 43 The definition and sizing tables were not added as the proposed piping material was not added to the code.

Public Comment No. 4-NFPA 54-2022 [Section No. 3.3.4.4.1]

3.3.4.4.1 Baking and Roasting Oven.

An oven primarily intended for volume food ~~preparation that is composed of one or more sections or units of the following types:~~ preparation

Add a new A.3.3.4.4.1 to read:

A.3.3.4.4.1 The types of baking and roasting ovens are:

(1) cabinet oven, an oven having one or more cavities heated by a single burner or group of burners

~~;~~

(2) reel-type oven, an oven employing trays that are moved by mechanical means

~~; or~~

(3) sectional oven, an oven composed of one or more independently heated cavities.

Statement of Problem and Substantiation for Public Comment

The committee rejected my PI 24 to move the types of baking and roasting ovens to Annex A stating: "The list of ovens that fall under baking or roasting ovens is helpful to the understanding of the definition". The simplified definition explains what baking and roasting ovens are and including "types" – which are not used in the code does not improve the definition.
The NFPA Manual of Style requires that definitions "only describe the term being Defined" (MOS-23.2.1). The terms Cabinet Oven, Reel-Type Oven, and Sectional Oven are not used in NFPA 54.
It is proposed to relocate the 3 oven types to Annex A so that they will remain available to Code users.

Related Item

• PI 24

Submitter Information Verification

Submitter Full Name: Theodore Lemoff
Organization: TLemoff Engineering
Affiliation: None
Street Address:
City:
State:
Zip:
Submittal Date: Fri Apr 01 13:37:25 EDT 2022
Committee: NFG-AAA

Committee Statement

Committee Action: Rejected but see related SR

Resolution:	SR-21-NFPA 54-2022
Statement:	Examples are being moved to the annex to clean up the definition.

Public Comment No. 15-NFPA 54-2022 [Section No. 3.3.4.5 [Excluding any Sub-Sections]]

An appliance for ~~domestic~~ food preparation, providing at least one function of (1) top or surface cooking, (2) oven cooking, or (3) broiling.

Statement of Problem and Substantiation for Public Comment

The definition is revised by deleting "domestic". As the term being defined is inherently a residential appliance the revised definition remains clear. The subsidiary definitions of various household appliances to not include the term "domestic".

Related Item

• PC 11

Submitter Information Verification

Submitter Full Name: Theodore Lemoff
Organization: TLemoff Engineering
Affiliation: None
Street Address:
City:
State:
Zip:
Submittal Date: Thu Apr 07 11:00:59 EDT 2022
Committee: NFG-AAA

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-22-NFPA 54-2022
Statement: As the term being defined is inherently a residential appliance the revised definition remains clear.

Public Comment No. 42-NFPA 54-2022 [New Section after 3.3.21]

3.3.22 Composite Pipe.

Pipe consisting of two or more different materials arranged with specific functional purpose to serve as pipe.

Statement of Problem and Substantiation for Public Comment

PEX-AL-PEX composite piping systems have characteristics of both metallic and plastic systems and can be construed as either metallic or plastic pipe depending on the familiarity of the system. Proven as a safe system to supply gas appliances in buildings for over 15 years, this system should not be classified as just another "plastic pipe." The definition presented here is consistent with that in ASTM F412 and is necessary for the proper categorization of PEX-AL-PEX.

Related Item

• Public Input No. 88-NFPA 54-2021

Submitter Information Verification

Submitter Full Name: Andrew Klein
Organization: A S Klein Engineering PLLC
Affiliation: Ferguson Enterprises
Street Address:
City:
State:
Zip:
Submittal Date: Mon May 30 23:41:41 EDT 2022
Committee: NFG-AAA

Committee Statement

Committee Action: Rejected

Resolution: Public Comments 41, 44, 45 The proposed composite tubing product (PEX-AL-PEX) as presented does not have a fire resistance that matches other similar metallic piping products that are currently recognized in Section 5.5 of the NFPA 54. The proposed PEX-AL-PEX fitting do not meet ANSI LC 4 for press-to-connect fittings (which requires 1000F). Brazing also requires a high temperature fitting (1000F). The ISO 17484-1 Standard proposed for the material does not include fire resistance requirements, and the proposed requirements do not require additional fire protection methods such as excess flow valves or external fire protection (installation behind gypsum walls). The requirement language did not require the listing to the ISO 17484-1 rather compliance to the standard. Public Comments 40, 42, 43 The definition and sizing tables were not added as the proposed piping material was not added to the code.

Public Comment No. 5-NFPA 54-2022 [Section No. 3.3.24]

~~**3.3.24** – Copper Alloy.~~

~~A homogenous mixture of two or more metals in which copper is the primary component, such as brass and bronze.~~

Statement of Problem and Substantiation for Public Comment

This definition is not needed as alloy is a commonly used word that is adequately defined in dictionaries. One dictionary definition is, “a metal made by combining two or more metallic elements, especially to give greater strength or resistance to corrosion”.

Related Item

• PI 28

Submitter Information Verification

Submitter Full Name: Theodore Lemoff
Organization: TLemoff Engineering
Affiliation: None
Street Address:
City:
State:
Zip:
Submittal Date: Fri Apr 01 13:45:06 EDT 2022
Committee: NFG-AAA

Committee Statement

Committee Action: Rejected

Resolution: The definition is needed as there is confusion in the field that a copper alloy's primary component is copper. Previously the terms bronze and brass were also replaced with copper alloy in the past and inclusion of those terms in the definition helps understanding of the material.

Public Comment No. 6-NFPA 54-2022 [Section No. 3.3.56.7]

3.3.56.7 Water Heater.

An appliance for supplying hot ~~water for domestic or commercial purposes.~~ water

Statement of Problem and Substantiation for Public Comment

PI 33 proposing the substituting of “residential” for “commercial” in this definition was rejected by the Committee with the statement:
Residential occupancies are broader than what the committee intends for these appliances. The appliance listing standard also refers to these appliances as domestic of household appliances and not residential.
This comment is similar, but simplifies the definition to apply to all appliance that supply hot water for any purposes. A water heater is a water heater no matter what the use of the heated water is.

Related Item

• PI 33

Submitter Information Verification

Submitter Full Name: Theodore Lemoff
Organization: TLemoff Engineering
Affiliation: None
Street Address:
City:
State:
Zip:
Submittal Date: Fri Apr 01 13:47:39 EDT 2022
Committee: NFG-AAA

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-23-NFPA 54-2022
Statement: The purpose of the heated water is irrelevant to definition.

Public Comment No. 7-NFPA 54-2022 [Section No. 3.3.83]

3.3.83 Qualified Agency.

Any individual, firm, corporation, or company that either in person or through a representative is engaged in and is responsible for (1) the design, installation, testing, or replacement of gas piping or (2) the connection, installation, testing, repair, or servicing ~~of appliances and~~ of equipment; that is experienced in such work; that is familiar with all precautions required; and that has complied with all the requirements of the authority having jurisdiction.

Statement of Problem and Substantiation for Public Comment

The committee rejected PI 36 stating, “Servicing of the appliances needs to be done by qualified agencies”.

It is noted that the scope of NPFA 54 in 1.1.1.1 states: “This code is a safety code that shall apply to the installation of fuel gas piping systems, appliances, equipment, and related accessories as shown in 1.1.1.1(A) through 1.1.1.1(F).

It is agreed that servicing of appliances must be done by qualified technicians. This qualification is in part the design and construction of appliances, which are not within the scope of this Code. Therefore, appliance repair is outside the scope of this Code.

Related Item

• PI 36

Submitter Information Verification

Submitter Full Name: Theodore Lemoff
Organization: TLemoff Engineering
Affiliation: None
Street Address:
City:
State:
Zip:
Submittal Date: Tue Apr 05 12:57:30 EDT 2022
Committee: NFG-AAA

Committee Statement

Committee Action: Rejected

Resolution: The phrase "of appliances" is needed as the connection, installation, testing, repair, or servicing of appliances is covered under NFPA 54. Additionally servicing of appliances is covered under the code.

Public Comment No. 37-NFPA 54-2022 [Section No. 3.3.85.3]

3.3.85.3 Line Pressure Regulator.

A pressure regulator placed in a gas line between the service regulator and the appliance ~~regulator~~ .

Statement of Problem and Substantiation for Public Comment

The scope of piping in NFPA 54 covers the piping from the point of deliver to the appliance. An appliance regulator is part of the appliance, and is outside the scope of the Code.

Related Item

• FR-12

Submitter Information Verification

Submitter Full Name: Theodore Lemoff
Organization: TLemoff Engineering
Affiliation: None
Street Address:
City:
State:
Zip:
Submittal Date: Fri May 20 13:35:17 EDT 2022
Committee: NFG-AAA

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-24-NFPA 54-2022
Statement: The scope of piping in NFPA 54 covers the piping from the point of deliver to the appliance shutoff valve.

Public Comment No. 41-NFPA 54-2022 [New Section after 5.5.4]

5.5.5. Composite Piping

5.5.5.1 Standard and Markings

5.5.5.1.1 Crosslinked PEX-Aluminum-PEX (PEX-AL-PEX) composite pipe and fittings used to supply fuel gas shall conform to ISO 17484-1. Such pipe shall be marked "Gas" and "ISO 17484".

Statement of Problem and Substantiation for Public Comment

This proposal ensures PEX-AL-PEX piping systems are properly listed and marked.

Related Item

• Public Input No. 88-NFPA 54-2021

Submitter Information Verification

Submitter Full Name: Andrew Klein
Organization: A S Klein Engineering PLLC
Affiliation: Ferguson Enterprises
Street Address:
City:
State:
Zip:
Submittal Date: Mon May 30 23:15:43 EDT 2022
Committee: NFG-AAA

Committee Statement

Committee Action: Rejected

Resolution: Public Comments 41, 44, 45 The proposed composite tubing product (PEX-AL-PEX) as presented does not have a fire resistance that matches other similar metallic piping products that are currently recognized in Section 5.5 of the NFPA 54. The proposed PEX-AL-PEX fitting do not meet ANSI LC 4 for press-to-connect fittings (which requires 1000F). Brazing also requires a high temperature fitting (1000F). The ISO 17484-1 Standard proposed for the material does not include fire resistance requirements, and the proposed requirements do not require additional fire protection methods such as excess flow valves or external fire protection (installation behind gypsum walls). The requirement language did not require the listing to the ISO 17484-1 rather compliance to the standard. Public Comments 40, 42, 43 The definition and sizing tables were not added as the proposed piping material was not added to the code.

Public Comment No. 46-NFPA 54-2022 [Section No. 5.5.4.2]

5.5.4.2* Regulator Vent Piping.

Plastic pipe and fittings used to connect regulator vents to remote vent terminations shall be PVC conforming to UL 651, *Schedule 40 and 80 Rigid PVC Conduit and Fittings*. ~~PVC vent piping shall not be installed indoors.~~

Statement of Problem and Substantiation for Public Comment

Since the 2001 edition, NFPA 58 “LP-Gas Code” has allowed the use of PVC conforming to ANSI/UL 651 to be exposed to the indoors where used to vent second stage regulators that are installed indoors. This practice is currently prohibited in the National Fuel Gas Code, but there is good reason to reconsider this prohibition.

- Using black iron or galvanized pipe or larger diameter copper tubing could impose excessive stresses on the regulator housing. When regulators had 1/4-inch vent openings, small diameter tubing used to extend vents imposed minimal stress on the regulator. However, regulators now install 1/2-, 3/4-, and 1-inch vent openings which lead to much greater stresses on the housing.
- UL 651 PVC conduit is tested for limited resistance to fire. However, LP-gas second stage and line pressure regulators, which are both approved for use inside buildings, are not required to be fire resistant. Regulators contain components which have low melting points. Plastic regulator vent caps and adjusting screws will melt at temperatures as low as 225°F, and the elastomer materials of regulator diaphragms and seat discs will fail at approximately 400°F. Therefore, there is no enhancement of safety in mandating fire-resistant vent piping, when the regulator assembly itself is not tested for fire resistance.
- A related concern is that in a large structure involved in fire, regulator vent piping may be exposed to fire while the regulator itself may not be. It is important to note that under most circumstances, regulator vent piping does not contain gas—it only carries gas when the regulator is in vent discharge mode. If the regulator itself is not involved in a fire, there is no reasonable expectation to believe that it will vent and therefore involvement of the vent piping alone in a fire does not pose any additional safety risk.

Related Item

- PI No. 121

Submitter Information Verification

Submitter Full Name: Bruce Swiecicki
Organization: National Propane Gas Associati
Affiliation: NPGA Technology, Standards and Safety Committee
Street Address:
City:
State:
Zip:
Submittal Date: Tue May 31 13:04:21 EDT 2022
Committee: NFG-AAA

Committee Statement

Committee Action: Rejected

Resolution: PVC piping material is still not acceptable to be installed indoors as there are questions on the integrity of the PVC vent piping indoors when exposed to fire. There are also questions on if UL 651 is the appropriate reference standard for indoor vent piping as there are concerns on fittings for the vent piping. Larger industrial and commercial installations could have longer vent pipe runs which are subject to physical damage. Static electricity is also a concern with plastic vent piping.

Public Comment No. 24-NFPA 54-2022 [Section No. 5.5.9.1.3]

5.5.9.1.3

Non-ferrous flanges shall be in accordance with ANSI/ASME B16.24, *Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 600. 900, 1500, and 2500*, except listed components using aluminum flange connections shall be permitted to be constructed in accordance with the dimensional specifications of ANSI/ASME B16 . 5 or ANSI/ASME B16.1.

Statement of Problem and Substantiation for Public Comment

This paragraph requires that listed components using aluminum flanges to be constructed to have flat face flange connections according a standard that applies to copper. Many listed components today use aluminum flanges, and they are made with either B16.1 (flat face) or ASME B16.5 (raised face) flanges. Additionally, the paragraph is in conflict with UL 429 for safety shutoff valves. UL 429 allows for aluminum flange connections to be ASME B16.1 (flat face) or ASME B16.5 (raised face), and this reflects also what the industry is doing today for listed components.

Related Item

• PI 78

Submitter Information Verification

Submitter Full Name: Kevin Carlisle
Organization: Karl Dungs, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Tue Apr 19 16:00:54 EDT 2022
Committee: NFG-AAA

Committee Statement

Committee Action: Rejected but see related SR

Resolution: SR-10-NFPA 54-2022

Statement: This paragraph requires that listed components using aluminum flanges to be constructed to have flat face flange connections according a standard that applies to copper. Many listed components today use aluminum flanges, and they are made with either B16.1 (flat face) or ASME B16.5 (raised face) flanges. Additionally, the paragraph is in conflict with UL 429 for safety shutoff valves. UL 429 allows for aluminum flange connections to be ASME B16.1 (flat face) or ASME B16.5 (raised face), and this reflects also what the industry is doing today for listed components.

Public Comment No. 17-NFPA 54-2022 [New Section after 5.5.10.5]

A5.5.10.5

ASME PCC-1, Guidelines for Pressure Boundary Bolted Flanged Joint Connections, contains information and guidelines for evaluating flange face defects.

Statement of Problem and Substantiation for Public Comment

This annex material helps to support this new requirement.

Related Item

• PI 48

Submitter Information Verification

Submitter Full Name: John Puskar
Organization: Prescient Technical Services L
Street Address:
City:
State:
Zip:
Submittal Date: Fri Apr 15 18:36:23 EDT 2022
Committee: NFG-AAA

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-11-NFPA 54-2022
Statement: Flanges need to be cleaned prior to inspection in order to have an accurate inspection and there was no requirement to clean the flange prior to inspection or replacement. Annex material is being added to add a guidance document on how to inspect flanges.

Public Comment No. 16-NFPA 54-2022 [Section No. 5.5.10.5]

5.5.10.5

When flanges are separated and before gaskets are replaced, the following shall be met:

(1) Flange surfaces shall be inspected for pitting, corrosion, and other surface defects.

(2) Flanges that contain pitting, corrosion, and other surface defects on faces shall be repaired or replaced.

(3) Flange faces shall be cleaned and restored to meet new gasket surface requirements.

Statement of Problem and Substantiation for Public Comment

It's not enough to say that flanges need to be inspected for pitting and corrosion, when gaskets are removed some of the old gasket remains embedded into grooves that are installed into the flange surfaces to created sealing. If these grooves are not re-established the new gasket will not seal properly.

Related Item

• PI 48

Submitter Information Verification

Submitter Full Name: John Puskar
Organization: Prescient Technical Services L
Street Address:
City:
State:
Zip:
Submittal Date: Fri Apr 15 18:31:36 EDT 2022
Committee: NFG-AAA

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-11-NFPA 54-2022
Statement: Flanges need to be cleaned prior to inspection in order to have an accurate inspection and there was no requirement to clean the flange prior to inspection or replacement. Annex material is being added to add a guidance document on how to inspect flanges.

Public Comment No. 27-NFPA 54-2022 [Section No. 5.6.3.2]

5.6.3.2

Where flexible connectors are used to connect a gas meter to downstream piping at manufactured homes in manufactured home parks and mobile home in mobile home parks , the meter shall be supported by a post or bracket placed in a firm footing or by other means providing equivalent support.

Statement of Problem and Substantiation for Public Comment

A mobile home is a prefabricated structure, built in a factory on a permanently attached chassis. Mobile homes are permanently or semi-permanently in one place, but can be moved, and may be required to move from time to time for legal reasons.

Manufactured homes are built entirely in the factory under a federal building code administered by (HUD). Manufactured homes may be single or multi-section and are transported to the site and installed on a permeant foundation and are not moveable.

Related Item

• Section 5.6.3.2

Submitter Information Verification

Submitter Full Name: Pennie Feehan
Organization: Pennie L. Feehan Consulting
Street Address:
City:
State:
Zip:
Submittal Date: Mon May 02 17:31:25 EDT 2022
Committee: NFG-AAA

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-12-NFPA 54-2022
Statement: A mobile home is a prefabricated structure, built in a factory on a permanently attached chassis. Mobile homes are permanently or semi-permanently in one place, but can be moved, and may be required to move from time to time for legal reasons.

Manufactured homes are built entirely in the factory under a federal building code administered by (HUD). Manufactured homes may be single or multi-section and are transported to the site and installed on a permeant foundation and are not moveable.

Public Comment No. 25-NFPA 54-2022 [Section No. 5.7.2]

5.7.2– _ Listing.

Line pressure regulators shall either

1) be listed in accordance with ANSI Z21.80/CSA 6.22, *Line Pressure Regulators*, where the outlet pressure is set to 2 psi or less, or

2)* incorporate a high and low gas pressure device downstream that shutdown the appliance served when high and low pressure is detected .

A.5.7.1(2) Each appliance downstream require a high and low gas pressure device if there are no high and low gas pressure devices located on the gas piping system serving those appliances.

Statement of Problem and Substantiation for Public Comment

Listed line pressure regulators are limited in their scope for industrial applications and large commercial applications for two reasons.
1) The maximum allowed outlet pressure for a listed line pressure regulator is 2 PSI. There are some industrial applications and large commercial applications that require 10 PSI at the burner.
2) There are some industrial applications and large commercial applications where the delivery pressure is less than 2 PSI, but the regulators used in these applications will not comply with ANSI Z21.80, Standard for line pressure regulators, for the following reasons.

- the standard for line pressure regulators ANSI Z21.80 requires that regulator be capable with flowing a minimum of 0.15CFH of natural gas. Many regulators used on industrial applications and large commercial applications today can be in the 5” – 8” pipe size, and these regulators cannot flow this small rate.

- the standard for line pressure regulators ANSI Z.21.80 requires that regulator be capable with passing a 100,000 life cycle test. Many regulators used on large industrial applications and large commercial applications today are big. To move the mechanical parts within a big regulator means bigger forces, and this leads to mechanical failure long before reaching 100,000 cycles.

- the standard for line pressure regulators ANSI Z.21.80 requires that regulator be capable of a lockup pressure of 150% of the setpoint or +5"WC, whichever is greater. Many regulators used on industrial applications and large commercial applications are pilot loaded, and thus cannot pass this ANSI Z.21.80 requirement. The pilot loaded regulator are much slower reacting than the typical, “direct acting” spring loaded regulators that are currently certified to ANSI Z21.80.

The proposed solution is good for all code users. Not only is it easy to enforce and reflects what these industries are currently doing, the requirement for high and low gas offers as-good-as or greater safety for these two reasons:
1. The devices are “safety” devices, subjected to the stringent safety requirements of UL 353 or UL 60739-2-5.
2. Regulator can fail because: a diaphragm fails, debris gets into the regulator mechanisms and causes the regulator to stick, a regulating disc breaks, there is a condition where there is too high or too low of an inlet pressure which causes significant droop, or there is an improper field adjustment or incorrect installation of a spring. These risks are all greatly mitigated when a line pressure regulator certified to ANSI Z21.80. However, those same risks are mitigated even more when using a high and low gas pressure device. These devices continuous monitor the outlet pressure of the upstream regulator during operation of the appliance, and any condition (for whatever reason) that causes the regulated pressure to exceed the settings of the devices, the appliance shuts down.

Related Item

• PI 18

Submitter Information Verification

Submitter Full Name: Kevin Carlisle
Organization: Karl Dungs, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Thu Apr 21 14:35:15 EDT 2022
Committee: NFG-AAA

Committee Statement

Committee Action: Rejected

Resolution: The proposed changes fall under a product listing standard rather than an installation standard. This proposal also potentially negates the need to have a listed line pressure regulator. The language also limits the alternative methods that are also acceptable protection methods.

Public Comment No. 28-NFPA 54-2022 [Section No. 5.8.3.1]

5.8.3.1

Overpressure protection devices shall be one of the following:

(1) Pressure relief valve.

(2) Monitor regulator.

(3) Series regulator installed upstream from the line regulator and set to continuously limit the pressure on the inlet of the line regulator ~~to the maximum values specified by 5.8.2.1 or less.~~ .

(4) Automatic manually reset shutoff device installed in series with the line pressure regulator ~~and set to shut off when the pressure on the downstream piping system reaches the maximum values specified by 5.8.2.1 or less. This device shall be designed so that it will remain closed until manually reset.~~ .

Statement of Problem and Substantiation for Public Comment

The requirement is revised editorially.

1. 5.8.3 1 is revised to remove the reference to 5.8.2.1 (the previous paragraph) as it is applicable and does not need to be restated.

2. 5.8.3.1 (3) is revised to delete reference 5.8.2.1 which is applicable and does not need to be restated.

3. 5.8.3.1 (4) is restated to delete reference to 5.8.2.1 as 5.8.2.1 does not need to be restated, and to combine the 2 sentences into one sentence.

Related Item

• CI 46

Submitter Information Verification

Submitter Full Name: John Puskar
Organization: Prescient Technical Services L
Street Address:
City:
State:
Zip:
Submittal Date: Thu May 12 04:26:32 EDT 2022
Committee: NFG-AAA

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-13-NFPA 54-2022

Statement: 5.8.3.1 (3) is revised to delete reference 5.8.2.1 which is applicable and does not need to be restated. 5.8.3.1 (4) is revised to delete reference to 5.8.2.1 as 5.8.2.1 does not need to be restated.

See Global SR 32 for related revisions on multi-requirement renumbering.

Public Comment No. 29-NFPA 54-2022 [Section No. 5.8.3.2]

5.8.3.2

~~The devices in 5.8.3.1 shall be installed either as an integral part of the service or line pressure regulator or as separate units. Where separate overpressure protection devices are installed, they shall comply with 5.8.4 through 5.8.9 .~~

1. Be constructed so that the operation of the device is not impaired by corrosion of external or internal parts by the gas

2. Be designed and installed so that they can be operated to determine that the valve components are free to operate as designed.

3. Prevent unauthorized operation.

Statement of Problem and Substantiation for Public Comment

5.8.3.2 is revised to incorporate the requirements of 5.8.4 thru 5.8.7 which are no longer needed.

Related Item

• CI 46

Submitter Information Verification

Submitter Full Name: John Puskar
Organization: Prescient Technical Services L
Street Address:
City:
State:
Zip:
Submittal Date: Thu May 12 04:30:35 EDT 2022
Committee: NFG-AAA

Committee Statement

Committee Action: Rejected
Resolution: The requirements in 5.8.4 through 5.8.7 are necessary for overpressure protection devices where they are not integrally part of the service or line pressure regulator.

Public Comment No. 30-NFPA 54-2022 [Sections 5.8.4, 5.8.5, 5.8.6, 5.8.7]

Sections 5.8.4, 5.8.5, 5.8.6, 5.8.7

~~**5.8.4** – Construction and Installation.~~

~~All overpressure protection devices shall meet the following requirements:~~

(1) ~~Be constructed of materials so that the operation of the device is not impaired by corrosion of external parts by the atmosphere or of internal parts by the gas.~~

(2) ~~Be designed and installed so they can be operated to determine whether the valve is free. The devices shall also be designed and installed so they can be tested to determine the pressure at which they operate and be examined for leakage when in the closed position.~~

~~**5.8.5** – External Control Piping.~~

~~External control piping shall be designed and installed so that damage to the control piping of one device does not render both the regulator and the overpressure protective device inoperative.~~

~~**5.8.6** – Setting.~~

~~Each pressure limiting or pressure relieving device shall be set so that the gas pressure supplied to the connected appliance(s) does not exceed the limits specified in 5.8.2.1 and 5.8.2.2 .~~

~~**5.8.7** – Unauthorized Operation.~~

~~Where unauthorized operation of any shutoff valve could render a pressure relieving valve or pressure limiting device inoperative, one of the following shall be accomplished:~~

(1) ~~The valve shall be locked in the open position. Instruct authorized personnel in the importance of leaving the shutoff valve open and of being present while the shutoff valve is closed so that it can be locked in the open position before leaving the premises.~~

(2) ~~Duplicate relief valves shall be installed, each having adequate capacity to protect the system, and arrange the isolating valves or three-way valve so that only one relief valve can be rendered inoperative at a time.~~

Statement of Problem and Substantiation for Public Comment

Removed per PC 28. These are now no longer needed with the revisions made to 5.8.3.1. These requirements are now incorporated into 5.8.3.2

5.8.6 is deleted as reference to 5.8.2.1 and 5.8.2.2 which are in the same Section are not needed.

Related Item

• CI 46

Submitter Information Verification

Submitter Full Name: John Puskar
Organization: Prescient Technical Services L
Street Address:

City:
State:
Zip:
Submittal Date: Thu May 12 04:34:57 EDT 2022
Committee: NFG-AAA

Committee Statement

Committee Action: Rejected

Resolution: The requirements in 5.8.4 through 5.8.7 are necessary for overpressure protection devices where they are not integrally part of the service or line pressure regulator.

Public Comment No. 31-NFPA 54-2022 [Section No. 5.8.8.2]

5.8.8.2

The discharge stack or vent line shall be:

a) at least the same size as the outlet of the pressure relieving device.

b) designed and installed to prevent the entry of insects, water, or other foreign materials that could cause blockage.

Statement of Problem and Substantiation for Public Comment

The additional requirements addresses an important factor in the design and installation of discharge piping to enhance safety.

Related Item

• fr 25

Submitter Information Verification

Submitter Full Name: John Puskar
Organization: Prescient Technical Services L
Street Address:
City:
State:
Zip:
Submittal Date: Thu May 12 04:39:47 EDT 2022
Committee: NFG-AAA

Committee Statement

Committee Action: Rejected
Resolution: The requirements are already covered in current 5.8.8.1 and do not need to be duplicated here.

Public Comment No. 32-NFPA 54-2022 [Section No. 5.8.9]

5.8.9 Size of Fittings, Pipe, and Openings.

The fittings, pipe, and openings located between the system to be protected and the pressure relieving device shall be sized to prevent hammering of the valve and to prevent ~~impairment of~~ reduction of relief capacity.

Statement of Problem and Substantiation for Public Comment

Impairment can mean many things, reduction speaks more directly to the actual condition we are looking to address with this item.

Related Item

• fr 25

Submitter Information Verification

Submitter Full Name: John Puskar
Organization: Prescient Technical Services L
Street Address:
City:
State:
Zip:
Submittal Date: Thu May 12 04:44:13 EDT 2022
Committee: NFG-AAA

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-15-NFPA 54-2022
Statement: Reduction of relief capacity is the concern when sizing fittings, pipe, and openings between the system and pressure relieving devices. The term hammering is being removed as it is unclear what the term is referring to and if sized correctly hammering is not a concern.

Public Comment No. 26-NFPA 54-2022 [Section No. 5.14]

5.14– Pressure Regulator and Pressure Control Venting.

5.14.1 Protection Against Discharge.

The venting of the atmospheric side of diaphragms in line pressure regulators, gas appliance regulators, and gas pressure limit controls shall be

~~in accordance with all of the following:An independent vent pipe to the outdoors, sized in accordance with the device manufacturer's instructions, shall be provided~~
p rovided where the location of a device is such that a discharge of fuel gas will cause a hazard.

~~For devices other than appliance regulators, vents shall not be required to be independent where the~~

5.14.2 Installation of Pressure Control Venting.

Where installed, pressure control venting of the atmospheric side of diaphragms in line pressure regulators, gas appliance regulators, and gas pressure limit controls shall be in accordance with this section.

5.14.2.1 The vent shall be independent, excluding approved vent designs for devices that are other than appliance regulators whose vents are connected to a common manifold designed in accordance with engineering methods to minimize backpressure in the event of diaphragm failure

~~and such design is approved.A regulator~~
.

5.14.2.2 The vent pipe shall vent to the outdoors, excluding regulators and vent limiting means

~~combination~~
combinations listed in accordance with ANSI Z21.80/CSA 6.22, *Line Pressure Regulators,*

~~shall not be required to be vented to the outdoors.A~~
listed gas appliance

~~regulator~~
regulators factory equipped with

~~a~~
vent limiting

~~device is not required to be vented to the outdoors.A listed~~
devices and listed gas pressure limit

~~control~~
controls that

~~is factory~~
are factory equipped with

~~a~~
vent limiting

~~device~~
devices and in accordance with UL 353, *Limit Controls,* or UL 60730-2-6, *Automatic Electrical Controls for Household and Similar Use, Part 2*

~~, shall not be required to be vented to the outdoors.Materials~~
.

5.14.2.3 The vent pipe shall be sized in accordance with the device manufacturer's instructions.

5.14.2.4 Vent piping shall be installed to minimize static loads and bending moments placed on the regulators and gas pressure control devices.

5.14.2.5 Vent piping from pressure regulators and gas pressure controls shall not be connected to a common manifold that serves a bleed line from a diaphragm-type gas valve.

5.14.3 Vent Materials.

Materials for vent piping shall be in accordance with Section 5.5 .

5.14.4 Vent Terminations.

5.14.4.1 The vent terminus shall be designed to prevent the entry of water, insects, and other foreign matter that could cause blockage.

- ~~Vent piping shall be installed to minimize static loads and bending moments placed on the regulators and gas pressure control devices.~~

5.14.4.2 Vents shall terminate not less than 3 ft (0.9 m) from a possible source of ignition.

5.14.4.3 At locations where a vent termination could be submerged during floods or snow accumulations, an antiflood-type breather vent fitting shall be installed, or the vent terminal shall be located above the height of the expected flood waters or snow.

- ~~Vent piping from pressure regulators and gas pressure controls shall not be connected to a common manifold that serves a bleed line from a diaphragm-type gas valve.~~

Additional Proposed Changes

File Name	Description	Approved
PC_on_FR_No._12_-_Final.docx		

Statement of Problem and Substantiation for Public Comment

In FR No. 12, Item (1) and new Item (5) do not work together logically. This PC breaks up the section into individual requirements and avoid conflicts. The attached document provides a clean version of the PC and shows where each provision from the original language was moved. The text was worded to include only one "shall" in each clause and to incorporate exceptions into the main requirement. This was done to coordinate this section with work the Editorial Task Group had already done.

Related Item
• Public Input No. 19 • FR No. 12

Submitter Information Verification

Submitter Full Name: Daniel Buuck
Organization: National Association of Home Builders
Street Address:
City:
State:
Zip:
Submittal Date: Fri Apr 29 13:08:27 EDT 2022
Committee: NFG-AAA

Committee Statement

Committee Action: Rejected
Resolution: The proposed revisions confused the concept of gas controls as opposed to gas pressure regulators

Public Comment – Clean Text Version

5.14 Pressure Regulator and Pressure Control Venting.

5.14.1 Protection Against Discharge.

The venting of the atmospheric side of diaphragms in line pressure regulators, gas appliance regulators, and gas pressure limit controls shall be provided where the location of a device is such that a discharge of fuel gas will cause a hazard.

5.14.2 Installation of Pressure Control Venting.

Where installed, pressure control venting of the atmospheric side of diaphragms in line pressure regulators, gas appliance regulators, and gas pressure limit controls shall be in accordance with this section.

5.14.2.1 The vent shall be independent, excluding approved vent designs for devices that are other than appliance regulators whose vents are connected to a common manifold designed in accordance with engineering methods to minimize backpressure in the event of diaphragm failure.

5.14.2.2 The vent pipe shall vent to the outdoors, excluding regulators and vent limiting means combinations listed in accordance with ANSI Z21.80/CSA 6.22, *Line Pressure Regulators*, listed gas appliance regulators factory equipped with vent limiting devices and listed gas pressure limit controls that are factory equipped with vent limiting devices and in accordance with UL 353, *Limit Controls*, or UL 60730-2-6, *Automatic Electrical Controls for Household and Similar Use, Part 2*.

5.14.2.3 The vent pipe shall be sized in accordance with the device manufacturer's instructions.

5.14.2.4 Vent piping shall be installed to minimize static loads and bending moments placed on the regulators and gas pressure control devices.

5.14.2.5 Vent piping from pressure regulators and gas pressure controls shall not be a connected to a common manifold that serves a bleed line from a diaphragm-type gas valve.

5.14.3 Vent Materials.

Materials for vent piping shall be in accordance with Section 5.5.

5.14.4 Vent Terminations.

5.14.4.1 The vent terminus shall be designed to prevent the entry of water, insects, and other foreign matter that could cause blockage.

5.14.4.2 Vents shall terminate not less than 3 ft (0.9 m) from a possible source of ignition.

5.14.4.3 At locations where a vent termination could be submerged during floods or snow accumulations, an antiflood-type breather vent fitting shall be installed, or the vent terminal shall be located above the height of the expected flood waters or snow.

5.14 Pressure Regulator and Pressure Control Venting.

5.14.1 Protection Against Discharge.

The venting of the atmospheric side of diaphragms in line pressure regulators, gas appliance regulators, and gas pressure limit controls shall be ~~in accordance with all of the following:~~

~~(1) An independent vent pipe to the outdoors, sized in accordance with the device manufacturer's instructions, shall be~~ provided where the location of a device is such that a discharge of fuel gas will cause a hazard.

5.14.2 Installation of Pressure Control Venting.

Where installed, pressure control venting [of the atmospheric side of diaphragms in line pressure regulators, gas appliance regulators, and gas pressure limit controls] shall be in accordance with this section.

5.14.2.1 ~~(2)~~ The vent shall be independent, excluding approved vent designs for ~~For~~ devices that are other than appliance regulators~~, vents shall not be required to be independent where the~~ whose vents are connected to a common manifold designed in accordance with engineering methods to minimize backpressure in the event of diaphragm failure ~~and such design is approved~~.

5.14.2.2 ~~(3)~~ The ~~-~~vent pipe shall vent to the outdoors, excluding ~~A~~ regulators and vent limiting means combinations listed in accordance with ANSI Z21.80/CSA 6.22, Line Pressure Regulators, ~~shall not be required to be vented to the outdoors.~~

~~(4) A~~ listed gas appliance regulators factory equipped with ~~a~~ vent limiting devices and ~~is not required to be vented to the outdoors.~~

~~(5) A~~ listed gas pressure limit controls that ~~is~~ are factory equipped with ~~a~~ vent limiting devices and in accordance with UL 353, Limit Controls, or UL 60730-2-6, Automatic Electrical Controls for Household and Similar Use, Part 2~~, shall not be required to be vented to the outdoors~~.

5.14.2.3 The vent pipe shall be sized in accordance with the device manufacturer's instructions.

5.14.2.4 Vent piping shall be installed to minimize static loads and bending moments placed on the regulators and gas pressure control devices.

5.14.2.5 Vent piping from pressure regulators and gas pressure controls shall not be a connected to a common manifold that serves a bleed line from a diaphragm-type gas valve.

5.14.3 Vent Materials.

~~(6)~~ Materials for vent piping shall be in accordance with Section 5.5.

5.14.4 Vent Terminations.

5.14.4.1 ~~(7)~~ The vent terminus shall be designed to prevent the entry of water, insects, and other foreign matter that could cause blockage.

~~(8) Vent piping shall be installed to minimize static loads and bending moments placed on the regulators and gas pressure control devices.~~

5.14.4.2 ~~(9)~~ Vents shall terminate not less than 3 ft (0.9 m) from a possible source of ignition.

5.14.4.3 ~~(10)~~ At locations where a vent termination could be submerged during floods or snow accumulations, an antiflood-type breather vent fitting shall be installed, or the vent terminal shall be located above the height of the expected flood waters or snow.

~~(11) Vent piping from pressure regulators and gas pressure controls shall not be a connected to a common manifold that serves a bleed line from a diaphragm-type gas valve.~~

Public Comment No. 38-NFPA 54-2022 [Section No. 5.14]

5.14 Pressure Regulator and Pressure Control Venting.

The venting of the atmospheric side of diaphragms in line pressure regulators, ~~gas appliance regulators,~~ _ and gas pressure limit controls shall be in accordance with all of the following:

(1) An independent vent pipe to the outdoors, sized in accordance with the device manufacturer's instructions, shall be provided where the location of a device is such that a discharge of fuel gas will cause a hazard.

(2) ~~For devices other than appliance regulators, vents~~ Independent vents multiple regulators shall not be required ~~to be independent where~~ where the vents are connected to a common manifold designed in accordance with engineering methods to minimize backpressure in the event of diaphragm failure and such design is approved.

(3) A regulator and vent limiting means combination listed in accordance with ANSI Z21.80/CSA 6.22, *Line Pressure Regulators,* shall not be required to be vented to the outdoors.

(4) A listed gas appliance regulator factory equipped with a vent limiting device is not required to be vented to the outdoors.

(5) A listed gas pressure limit control that is factory equipped with a vent limiting device and in accordance with UL 353, *Limit Controls,* or UL 60730-2-6, *Automatic Electrical Controls for Household and Similar Use, Part 2,* shall not be required to be vented to the outdoors.

(6) Materials for vent piping shall be in accordance with Section 5.5.

(7) The vent terminus shall be designed to prevent the entry of water, insects, and other foreign matter that could cause blockage.

(8) Vent piping shall be installed to minimize static loads and bending moments placed on the regulators and gas pressure control devices.

(9) Vents shall terminate not less than 3 ft (0.9 m) from a possible source of ignition.

(10) At locations where a vent termination could be submerged during floods or snow accumulations, an antiflood-type breather vent fitting shall be installed, or the vent terminal shall be located above the height of the expected flood waters or snow.

(11) Vent piping from pressure regulators and gas pressure controls shall not be connected to a common manifold that serves a bleed line from a diaphragm-type gas valve.

Statement of Problem and Substantiation for Public Comment

Appliance regulators are part of appliances, which are outside the scope of NFPA 54. Reference to appliance regulator venting is deleted from the Code. As venting of appliance regulators is not included in the requirements of 5.14, this is an editorial revision.

Related Item

• PC-12

Submitter Information Verification

Submitter Full Name: Theodore Lemoff
Organization: TLemoff Engineering
Affiliation: None

Street Address:
City:
State:
Zip:
Submittal Date: Fri May 20 13:39:57 EDT 2022
Committee: NFG-AAA

Committee Statement

Committee Action: Rejected but see related SR

Resolution: SR-29-NFPA 54-2022

Statement: Appliance regulators are part of appliances, which are outside the scope of NFPA 54. Reference to appliance regulator venting is deleted from the Code.

See Global SR 31 for changes to 5.14(10)

Public Comment No. 43-NFPA 54-2022 [Chapter 6]

Chapter 6 Pipe Sizing

6.1* Pipe Sizing Methods.

Where the pipe size is to be determined using any of the methods in 6.1.2 through 6.1.4, the diameter of each pipe segment shall be obtained from the pipe sizing tables in Section 6.2,Section 6.3, the sizing tables included in a listed piping system manufacturer's installation instructions, or from the sizing equations in Section 6.4.

6.1.1 US to SI Conversions.

For SI units, the following shall apply: 1 ft^3 = 0.028 m^3, 1 ft = 0.305 m, 1 in. w.c. = 0.249 kPa, 1 psi = 6.894 kPa, 1000 Btu/hr = 0.293 kW.

6.1.2* 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.

6.1.3* Branch Length Method.

Pipe shall be sized as follows:

(1) 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.

(2) 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.

6.1.4 Hybrid Pressure.

The pipe size for each section of higher pressure gas piping shall be determined using the longest length of piping from the point of delivery to the most remote line pressure regulator. The pipe size from the line pressure regulator to each outlet shall be determined using the length of piping from the regulator to the most remote outlet served by the regulator.

6.2 Sizing Natural Gas Piping Systems.

Sizing of piping systems shall be in accordance with 6.2.1 or 6.2.2.

6.2.1

Table 6.2.1(a) through Table 6.2.1(x) shall be used in conjunction with one of the methods described in 6.1.2 through 6.1.4 for piping materials other than non-corrugated stainless steel tubing.

Table 6.2.1(a) Schedule 40 Metallic Pipe

-	-	-	-	-	-	-	-	-	-	-	**Gas:**
-	-	-	-	-	-	-	-	-	-	-	**Inlet Pressure:**
-	-	-	-	-	-	-	-	-	-	-	**Pressure Drop:**
-	-	-	-	-	-	-	-	-	-	-	**Specific Gravity:**
-	**Pipe Size (in.)**										
Nominal:	½	¾	1	1¼	1½	2	2½	3	4	5	6	8
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**
Length (ft)	**Capacity in Cubic Feet of Gas per Hour**											
10	131	273	514	1,060	1,580	3,050	4,860	8,580	17,500	31,700	51,300	105,000
20	90	188	353	726	1,090	2,090	3,340	5,900	12,000	21,800	35,300	72,400
30	72	151	284	583	873	1,680	2,680	4,740	9,660	17,500	28,300	58,200
40	62	129	243	499	747	1,440	2,290	4,050	8,270	15,000	24,200	49,800
50	55	114	215	442	662	1,280	2,030	3,590	7,330	13,300	21,500	44,100
60	50	104	195	400	600	1,160	1,840	3,260	6,640	12,000	19,500	40,000
70	46	95	179	368	552	1,060	1,690	3,000	6,110	11,100	17,900	36,800
80	42	89	167	343	514	989	1,580	2,790	5,680	10,300	16,700	34,200
90	40	83	157	322	482	928	1,480	2,610	5,330	9,650	15,600	32,100
100	38	79	148	304	455	877	1,400	2,470	5,040	9,110	14,800	30,300
125	33	70	131	269	403	777	1,240	2,190	4,460	8,080	13,100	26,900
150	30	63	119	244	366	704	1,120	1,980	4,050	7,320	11,900	24,300
175	28	58	109	224	336	648	1,030	1,820	3,720	6,730	10,900	22,400
200	26	54	102	209	313	602	960	1,700	3,460	6,260	10,100	20,800
250	23	48	90	185	277	534	851	1,500	3,070	5,550	8,990	18,500
300	21	43	82	168	251	484	771	1,360	2,780	5,030	8,150	16,700
350	19	40	75	154	231	445	709	1,250	2,560	4,630	7,490	15,400
400	18	37	70	143	215	414	660	1,170	2,380	4,310	6,970	14,300
450	17	35	66	135	202	389	619	1,090	2,230	4,040	6,540	13,400
500	16	33	62	127	191	367	585	1,030	2,110	3,820	6,180	12,700
550	15	31	59	121	181	349	556	982	2,000	3,620	5,870	12,100
600	14	30	56	115	173	333	530	937	1,910	3,460	5,600	11,500
650	14	29	54	110	165	318	508	897	1,830	3,310	5,360	11,000
700	13	27	52	106	159	306	488	862	1,760	3,180	5,150	10,600
750	13	26	50	102	153	295	470	830	1,690	3,060	4,960	10,200
800	12	26	48	99	148	285	454	802	1,640	2,960	4,790	9,840
850	12	25	46	95	143	275	439	776	1,580	2,860	4,640	9,530
900	11	24	45	93	139	267	426	752	1,530	2,780	4,500	9,240

950	11	23	44	90	135	259	413	731	1,490	2,700	4,370	8,970
1,000	11	23	43	87	131	252	402	711	1,450	2,620	4,250	8,720
1,100	10	21	40	83	124	240	382	675	1,380	2,490	4,030	8,290
1,200	NA	20	39	79	119	229	364	644	1,310	2,380	3,850	7,910
1,300	NA	20	37	76	114	219	349	617	1,260	2,280	3,680	7,570
1,400	NA	19	35	73	109	210	335	592	1,210	2,190	3,540	7,270
1,500	NA	18	34	70	105	203	323	571	1,160	2,110	3,410	7,010
1,600	NA	18	33	68	102	196	312	551	1,120	2,030	3,290	6,770
1,700	NA	17	32	66	98	189	302	533	1,090	1,970	3,190	6,550
1,800	NA	16	31	64	95	184	293	517	1,050	1,910	3,090	6,350
1,900	NA	16	30	62	93	178	284	502	1,020	1,850	3,000	6,170
2,000	NA	16	29	60	90	173	276	488	1,000	1,800	2,920	6,000

NA: A flow of less than 10 cfh.

Note: All table entries are rounded to 3 significant digits.

Table 6.2.1(b) Schedule 40 Metallic Pipe

-	-	-	-	-	-	-	-	-	-	-	**Gas:**
-	-	-	-	-	-	-	-	-	-	-	**Inlet Pressure:**
-	-	-	-	-	-	-	-	-	-	-	**Pressure Drop:**
-	-	-	-	-	-	-	-	-	-	-	**Specific Gravity:**

-	**Pipe Size (in.)**										
Nominal:	½	¾	**1**	**1¼**	**1½**	**2**	**2½**	**3**	**4**	**5**	**6**	**8**
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**
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
20	118	247	466	957	1,430	2,760	4,400	7,780	15,900	28,700	46,500	95,500
30	95	199	374	768	1,150	2,220	3,530	6,250	12,700	23,000	37,300	76,700
40	81	170	320	657	985	1,900	3,020	5,350	10,900	19,700	31,900	65,600
50	72	151	284	583	873	1,680	2,680	4,740	9,660	17,500	28,300	58,200
60	65	137	257	528	791	1,520	2,430	4,290	8,760	15,800	25,600	52,700
70	60	126	237	486	728	1,400	2,230	3,950	8,050	14,600	23,600	48,500
80	56	117	220	452	677	1,300	2,080	3,670	7,490	13,600	22,000	45,100
90	52	110	207	424	635	1,220	1,950	3,450	7,030	12,700	20,600	42,300
100	50	104	195	400	600	1,160	1,840	3,260	6,640	12,000	19,500	40,000
125	44	92	173	355	532	1,020	1,630	2,890	5,890	10,600	17,200	35,400
150	40	83	157	322	482	928	1,480	2,610	5,330	9,650	15,600	32,100
175	37	77	144	296	443	854	1,360	2,410	4,910	8,880	14,400	29,500
200	34	71	134	275	412	794	1,270	2,240	4,560	8,260	13,400	27,500
250	30	63	119	244	366	704	1,120	1,980	4,050	7,320	11,900	24,300
300	27	57	108	221	331	638	1,020	1,800	3,670	6,630	10,700	22,100

350	25	53	99	203	305	587	935	1,650	3,370	6,100	9,880	20,300
400	23	49	92	189	283	546	870	1,540	3,140	5,680	9,190	18,900
450	22	46	86	177	266	512	816	1,440	2,940	5,330	8,620	17,700
500	21	43	82	168	251	484	771	1,360	2,780	5,030	8,150	16,700
550	20	41	78	159	239	459	732	1,290	2,640	4,780	7,740	15,900
600	19	39	74	152	228	438	699	1,240	2,520	4,560	7,380	15,200
650	18	38	71	145	218	420	669	1,180	2,410	4,360	7,070	14,500
700	17	36	68	140	209	403	643	1,140	2,320	4,190	6,790	14,000
750	17	35	66	135	202	389	619	1,090	2,230	4,040	6,540	13,400
800	16	34	63	130	195	375	598	1,060	2,160	3,900	6,320	13,000
850	16	33	61	126	189	363	579	1,020	2,090	3,780	6,110	12,600
900	15	32	59	122	183	352	561	992	2,020	3,660	5,930	12,200
950	15	31	58	118	178	342	545	963	1,960	3,550	5,760	11,800
1,000	14	30	56	115	173	333	530	937	1,910	3,460	5,600	11,500
1,100	14	28	53	109	164	316	503	890	1,810	3,280	5,320	10,900
1,200	13	27	51	104	156	301	480	849	1,730	3,130	5,070	10,400
1,300	12	26	49	100	150	289	460	813	1,660	3,000	4,860	9,980
1,400	12	25	47	96	144	277	442	781	1,590	2,880	4,670	9,590
1,500	11	24	45	93	139	267	426	752	1,530	2,780	4,500	9,240
1,600	11	23	44	89	134	258	411	727	1,480	2,680	4,340	8,920
1,700	11	22	42	86	130	250	398	703	1,430	2,590	4,200	8,630
1,800	10	22	41	84	126	242	386	682	1,390	2,520	4,070	8,370
1,900	10	21	40	81	122	235	375	662	1,350	2,440	3,960	8,130
2,000	NA	20	39	79	119	229	364	644	1,310	2,380	3,850	7,910

NA: A flow of less than 10 cfh.

Note: All table entries are rounded to 3 significant digits.

Table 6.2.1(c) Schedule 40 Metallic Pipe

-	-	-	-	-	-	**Gas:**	**Natural**
-	-	-	-	-	-	**Inlet Pressure:**	**Less than 2 psi**
-	-	-	-	-	-	**Pressure Drop:**	**3.0 in. w.c.**
-	-	-	-	-	-	**Specific Gravity:**	**0.60**

INTENDED USE: Initial supply pressure of 8.0 in. w.c. or greater

	Pipe Size (in.)								
Nominal:	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 (ft)	**Capacity in Thousands of Btu per Hour**								
10	454	949	1,790	3,670	5,500	10,600	16,900	29,800	60,800
20	312	652	1,230	2,520	3,780	7,280	11,600	20,500	41,800
30	250	524	986	2,030	3,030	5,840	9,310	16,500	33,600
40	214	448	844	1,730	2,600	5,000	7,970	14,100	28,700
50	190	397	748	1,540	2,300	4,430	7,060	12,500	25,500
60	172	360	678	1,390	2,090	4,020	6,400	11,300	23,100

Gas:	Natural
Inlet Pressure:	Less than 2 psi
Pressure Drop:	3.0 in. w.c.
Specific Gravity:	0.60

INTENDED USE: Initial supply pressure of 8.0 in. w.c. or greater

	Pipe Size (in.)								
Nominal:	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 (ft)	Capacity in Thousands of Btu per Hour								
70	158	331	624	1,280	1,920	3,690	5,890	10,400	21,200
80	147	308	580	1,190	1,790	3,440	5,480	9,690	19,800
90	138	289	544	1,120	1,670	3,230	5,140	9,090	18,500
100	131	273	514	1,060	1,580	3,050	4,860	8,580	17,500
125	116	242	456	936	1,400	2,700	4,300	7,610	15,500
150	105	219	413	848	1,270	2,450	3,900	6,890	14,100
175	96	202	380	780	1,170	2,250	3,590	6,340	12,900
200	90	188	353	726	1,090	2,090	3,340	5,900	12,000
250	80	166	313	643	964	1,860	2,960	5,230	10,700
300	72	151	284	583	873	1,680	2,680	4,740	9,660
350	66	139	261	536	803	1,550	2,470	4,360	8,890
400	62	129	243	499	747	1,440	2,290	4,050	8,270
450	58	121	228	468	701	1,350	2,150	3,800	7,760
500	55	114	215	442	662	1,280	2,030	3,590	7,330
550	52	109	204	420	629	1,210	1,930	3,410	6,960
600	50	104	195	400	600	1,160	1,840	3,260	6,640
650	47	99	187	384	575	1,110	1,760	3,120	6,360
700	46	95	179	368	552	1,060	1,690	3,000	6,110
750	44	92	173	355	532	1,020	1,630	2,890	5,890
800	42	89	167	343	514	989	1,580	2,790	5,680
850	41	86	162	332	497	957	1,530	2,700	5,500
900	40	83	157	322	482	928	1,480	2,610	5,330
950	39	81	152	312	468	901	1,440	2,540	5,180
1000	38	79	148	304	455	877	1,400	2,470	5,040
1100	36	75	141	289	432	833	1,330	2,350	4,780
1200	34	71	134	275	412	794	1,270	2,240	4,560
1300	33	68	128	264	395	761	1,210	2,140	4,370
1400	31	65	123	253	379	731	1,160	2,060	4,200
1500	30	63	119	244	366	704	1,120	1,980	4,050
1600	29	61	115	236	353	680	1,080	1,920	3,910
1700	28	59	111	228	342	658	1,050	1,850	3,780
1800	27	57	108	221	331	638	1,020	1,800	3,670
1900	27	56	105	215	322	619	987	1,750	3,560
2000	26	54	102	209	313	602	960	1,700	3,460

Note: All table entries are rounded to 3 significant digits.

Table 6.2.1(d) Schedule 40 Metallic Pipe

						Gas:	Natural		
						Inlet Pressure:	Less than 2 psi		
						Pressure Drop:	6.0 in. w.c.		
						Specific Gravity:	0.6		
INTENDED USE: Initial supply pressure of 11.0 in. w.c. or greater									
	Pipe Size (in.)								
Nominal:	**½**	**¾**	**1**	**1¼**	**1½**	**2**	**2½**	**3**	**4**
Actual ID:	**0.622**	**0.824**	**1.049**	**1.38**	**1.61**	**2.067**	**2.469**	**3.068**	**4.026**
Length (ft)	**Capacity in Cubic Feet of Gas per Hour**								
10	660	1,380	2,600	5,340	8,000	15,400	24,600	43,400	88,500
20	454	949	1,790	3,670	5,500	10,600	16,900	29,800	60,800
30	364	762	1,440	2,950	4,410	8,500	13,600	24,000	48,900
40	312	652	1,230	2,520	3,780	7,280	11,600	20,500	41,800
50	276	578	1,090	2,240	3,350	6,450	10,300	18,200	37,100
60	250	524	986	2,030	3,030	5,840	9,310	16,500	33,600
70	230	482	907	1,860	2,790	5,380	8,570	15,100	30,900
80	214	448	844	1,730	2,600	5,000	7,970	14,100	28,700
90	201	420	792	1,630	2,440	4,690	7,480	13,200	27,000
100	190	397	748	1,540	2,300	4,430	7,060	12,500	25,500
125	168	352	663	1,360	2,040	3,930	6,260	11,100	22,600
150	153	319	601	1,230	1,850	3,560	5,670	10,000	20,500
175	140	293	553	1,140	1,700	3,270	5,220	9,230	18,800
200	131	273	514	1,056	1,580	3,050	4,860	8,580	17,500
250	116	242	456	936	1,400	2,700	4,300	7,610	15,500
300	105	219	413	848	1,270	2,450	3,900	6,890	14,100
350	96	202	380	780	1,170	2,250	3,590	6,340	12,900
400	90	188	353	726	1,090	2,090	3,340	5,900	12,000
450	84	176	332	681	1,020	1,960	3,130	5,540	11,300
500	80	166	313	643	964	1,860	2,960	5,230	10,700
550	76	158	297	611	915	1,760	2,810	4,970	10,100
600	72	151	284	583	873	1,680	2,680	4,740	9,660
650	69	144	272	558	836	1,610	2,570	4,540	9,250
700	66	139	261	536	803	1,550	2,470	4,360	8,890
750	64	134	252	516	774	1,490	2,380	4,200	8,560
800	62	129	243	499	747	1,440	2,290	4,050	8,270
850	60	125	235	483	723	1,390	2,220	3,920	8,000
900	58	121	228	468	701	1,350	2,150	3,800	7,760
950	56	118	221	454	681	1,310	2,090	3,690	7,540
1,000	55	114	215	442	662	1,280	2,030	3,590	7,330
1,100	52	109	204	420	629	1,210	1,930	3,410	6,960
1,200	50	104	195	400	600	1,160	1,840	3,260	6,640

1,300	47	99	187	384	575	1,110	1,760	3,120	6,360
1,400	46	95	179	368	552	1,060	1,690	3,000	6,110
1,500	44	92	173	355	532	1,020	1,630	2,890	5,890
1,600	42	89	167	343	514	989	1,580	2,790	5,680
1,700	41	86	162	332	497	957	1,530	2,700	5,500
1,800	40	83	157	322	482	928	1,480	2,610	5,330
1,900	39	81	152	312	468	901	1,440	2,540	5,180
2,000	38	79	148	304	455	877	1,400	2,470	5,040

Note: All table entries are rounded to 3 significant digits.

Table 6.2.1(e) Schedule 40 Metallic Pipe

-	-	-	-	-	-	**Gas:**	**Natural**
-	-	-	-	-	-	**Inlet Pressure:**	**2.0 psi**
-	-	-	-	-	-	**Pressure Drop:**	**1.0 psi**
-	-	-	-	-	-	**Specific Gravity:**	**0.60**

-	**Pipe Size (in.)**								
Nominal:	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 (ft)	**Capacity in Cubic Feet of Gas per Hour**								
10	1,510	3,040	5,560	11,400	17,100	32,900	52,500	92,800	189,000
20	1,070	2,150	3,930	8,070	12,100	23,300	37,100	65,600	134,000
30	869	1,760	3,210	6,590	9,880	19,000	30,300	53,600	109,000
40	753	1,520	2,780	5,710	8,550	16,500	26,300	46,400	94,700
50	673	1,360	2,490	5,110	7,650	14,700	23,500	41,500	84,700
60	615	1,240	2,270	4,660	6,980	13,500	21,400	37,900	77,300
70	569	1,150	2,100	4,320	6,470	12,500	19,900	35,100	71,600
80	532	1,080	1,970	4,040	6,050	11,700	18,600	32,800	67,000
90	502	1,010	1,850	3,810	5,700	11,000	17,500	30,900	63,100
100	462	934	1,710	3,510	5,260	10,100	16,100	28,500	58,200
125	414	836	1,530	3,140	4,700	9,060	14,400	25,500	52,100
150	372	751	1,370	2,820	4,220	8,130	13,000	22,900	46,700
175	344	695	1,270	2,601	3,910	7,530	12,000	21,200	43,300
200	318	642	1,170	2,410	3,610	6,960	11,100	19,600	40,000
250	279	583	1,040	2,140	3,210	6,180	9,850	17,400	35,500
300	253	528	945	1,940	2,910	5,600	8,920	15,800	32,200
350	232	486	869	1,790	2,670	5,150	8,210	14,500	29,600
400	216	452	809	1,660	2,490	4,790	7,640	13,500	27,500
450	203	424	759	1,560	2,330	4,500	7,170	12,700	25,800
500	192	401	717	1,470	2,210	4,250	6,770	12,000	24,400
550	182	381	681	1,400	2,090	4,030	6,430	11,400	23,200
600	174	363	650	1,330	2,000	3,850	6,130	10,800	22,100
650	166	348	622	1,280	1,910	3,680	5,870	10,400	21,200
700	160	334	598	1,230	1,840	3,540	5,640	9,970	20,300

-	-	-	-	-	-	Gas:	Natural		
-	-	-	-	-	-	Inlet Pressure:	2.0 psi		
-	-	-	-	-	-	Pressure Drop:	1.0 psi		
-	-	-	-	-	-	Specific Gravity:	0.60		
-	Pipe Size (in.)								
Nominal:	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 (ft)	Capacity in Cubic Feet of Gas per Hour								
750	154	322	576	1,180	1,770	3,410	5,440	9,610	19,600
800	149	311	556	1,140	1,710	3,290	5,250	9,280	18,900
850	144	301	538	1,100	1,650	3,190	5,080	8,980	18,300
900	139	292	522	1,070	1,600	3,090	4,930	8,710	17,800
950	135	283	507	1,040	1,560	3,000	4,780	8,460	17,200
1,000	132	275	493	1,010	1,520	2,920	4,650	8,220	16,800
1,100	125	262	468	960	1,440	2,770	4,420	7,810	15,900
1,200	119	250	446	917	1,370	2,640	4,220	7,450	15,200
1,300	114	239	427	878	1,320	2,530	4,040	7,140	14,600
1,400	110	230	411	843	1,260	2,430	3,880	6,860	14,000
1,500	106	221	396	812	1,220	2,340	3,740	6,600	13,500
1,600	102	214	382	784	1,180	2,260	3,610	6,380	13,000
1,700	99	207	370	759	1,140	2,190	3,490	6,170	12,600
1,800	96	200	358	736	1,100	2,120	3,390	5,980	12,200
1,900	93	195	348	715	1,070	2,060	3,290	5,810	11,900
2,000	91	189	339	695	1,040	2,010	3,200	5,650	11,500

Note: All table entries are rounded to 3 significant digits.

Table 6.2.1(f) Schedule 40 Metallic Pipe

-	-	-	-	-	-	Gas:	Natural		
-	-	-	-	-	-	Inlet Pressure:	3.0 psi		
-	-	-	-	-	-	Pressure Drop:	2.0 psi		
-	-	-	-	-	-	Specific Gravity:	0.60		
-	Pipe Size (in.)								
Nominal:	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 (ft)	Capacity in Cubic Feet of Gas per Hour								
10	2,350	4,920	9,270	19,000	28,500	54,900	87,500	155,000	316,000
20	1,620	3,380	6,370	13,100	19,600	37,700	60,100	106,000	217,000
30	1,300	2,720	5,110	10,500	15,700	30,300	48,300	85,400	174,000
40	1,110	2,320	4,380	8,990	13,500	25,900	41,300	73,100	149,000
50	985	2,060	3,880	7,970	11,900	23,000	36,600	64,800	132,000
60	892	1,870	3,520	7,220	10,800	20,800	33,200	58,700	120,000
70	821	1,720	3,230	6,640	9,950	19,200	30,500	54,000	110,000
80	764	1,600	3,010	6,180	9,260	17,800	28,400	50,200	102,000

-	-	-	-	-	-	Gas:	Natural		
-	-	-	-	-	-	Inlet Pressure:	3.0 psi		
-	-	-	-	-	-	Pressure Drop:	2.0 psi		
-	-	-	-	-	-	Specific Gravity:	0.60		
-	Pipe Size (in.)								
Nominal:	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 (ft)	Capacity in Cubic Feet of Gas per Hour								
90	717	1,500	2,820	5,800	8,680	16,700	26,700	47,100	96,100
100	677	1,420	2,670	5,470	8,200	15,800	25,200	44,500	90,800
125	600	1,250	2,360	4,850	7,270	14,000	22,300	39,500	80,500
150	544	1,140	2,140	4,400	6,590	12,700	20,200	35,700	72,900
175	500	1,050	1,970	4,040	6,060	11,700	18,600	32,900	67,100
200	465	973	1,830	3,760	5,640	10,900	17,300	30,600	62,400
250	412	862	1,620	3,330	5,000	9,620	15,300	27,100	55,300
300	374	781	1,470	3,020	4,530	8,720	13,900	24,600	50,100
350	344	719	1,350	2,780	4,170	8,020	12,800	22,600	46,100
400	320	669	1,260	2,590	3,870	7,460	11,900	21,000	42,900
450	300	627	1,180	2,430	3,640	7,000	11,200	19,700	40,200
500	283	593	1,120	2,290	3,430	6,610	10,500	18,600	38,000
550	269	563	1,060	2,180	3,260	6,280	10,000	17,700	36,100
600	257	537	1,010	2,080	3,110	5,990	9,550	16,900	34,400
650	246	514	969	1,990	2,980	5,740	9,150	16,200	33,000
700	236	494	931	1,910	2,860	5,510	8,790	15,500	31,700
750	228	476	897	1,840	2,760	5,310	8,470	15,000	30,500
800	220	460	866	1,780	2,660	5,130	8,180	14,500	29,500
850	213	445	838	1,720	2,580	4,960	7,910	14,000	28,500
900	206	431	812	1,670	2,500	4,810	7,670	13,600	27,700
950	200	419	789	1,620	2,430	4,670	7,450	13,200	26,900
1,000	195	407	767	1,580	2,360	4,550	7,240	12,800	26,100
1,100	185	387	729	1,500	2,240	4,320	6,890	12,200	24,800
1,200	177	369	695	1,430	2,140	4,120	6,570	11,600	23,700
1,300	169	353	666	1,370	2,050	3,940	6,290	11,100	22,700
1,400	162	340	640	1,310	1,970	3,790	6,040	10,700	21,800
1,500	156	327	616	1,270	1,900	3,650	5,820	10,300	21,000
1,600	151	316	595	1,220	1,830	3,530	5,620	10,000	20,300
1,700	146	306	576	1,180	1,770	3,410	5,440	9,610	19,600
1,800	142	296	558	1,150	1,720	3,310	5,270	9,320	19,000
1,900	138	288	542	1,110	1,670	3,210	5,120	9,050	18,400
2,000	134	280	527	1,080	1,620	3,120	4,980	8,800	18,000

Note: All table entries are rounded to 3 significant digits.

Table 6.2.1(g) Schedule 40 Metallic Pipe

-	-	-	-	-	-	Gas:	Natural

-	-	-	-	-	-	**Inlet Pressure:**	**5.0 psi**		
-	-	-	-	-	-	**Pressure Drop:**	**3.5 psi**		
-	-	-	-	-	-	**Specific Gravity:**	**0.60**		
-	**Pipe Size (in.)**								
Nominal:	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 (ft)	**Capacity in Cubic Feet of Gas per Hour**								
10	3,190	6,430	11,800	24,200	36,200	69,700	111,000	196,000	401,000
20	2,250	4,550	8,320	17,100	25,600	49,300	78,600	139,000	283,000
30	1,840	3,720	6,790	14,000	20,900	40,300	64,200	113,000	231,000
40	1,590	3,220	5,880	12,100	18,100	34,900	55,600	98,200	200,000
50	1,430	2,880	5,260	10,800	16,200	31,200	49,700	87,900	179,000
60	1,300	2,630	4,800	9,860	14,800	28,500	45,400	80,200	164,000
70	1,200	2,430	4,450	9,130	13,700	26,400	42,000	74,300	151,000
80	1,150	2,330	4,260	8,540	12,800	24,700	39,300	69,500	142,000
90	1,060	2,150	3,920	8,050	12,100	23,200	37,000	65,500	134,000
100	979	1,980	3,620	7,430	11,100	21,400	34,200	60,400	123,000
125	876	1,770	3,240	6,640	9,950	19,200	30,600	54,000	110,000
150	786	1,590	2,910	5,960	8,940	17,200	27,400	48,500	98,900
175	728	1,470	2,690	5,520	8,270	15,900	25,400	44,900	91,600
200	673	1,360	2,490	5,100	7,650	14,700	23,500	41,500	84,700
250	558	1,170	2,200	4,510	6,760	13,000	20,800	36,700	74,900
300	506	1,060	1,990	4,090	6,130	11,800	18,800	33,300	67,800
350	465	973	1,830	3,760	5,640	10,900	17,300	30,600	62,400
400	433	905	1,710	3,500	5,250	10,100	16,100	28,500	58,100
450	406	849	1,600	3,290	4,920	9,480	15,100	26,700	54,500
500	384	802	1,510	3,100	4,650	8,950	14,300	25,200	51,500
550	364	762	1,440	2,950	4,420	8,500	13,600	24,000	48,900
600	348	727	1,370	2,810	4,210	8,110	12,900	22,900	46,600
650	333	696	1,310	2,690	4,030	7,770	12,400	21,900	44,600
700	320	669	1,260	2,590	3,880	7,460	11,900	21,000	42,900
750	308	644	1,210	2,490	3,730	7,190	11,500	20,300	41,300
800	298	622	1,170	2,410	3,610	6,940	11,100	19,600	39,900
850	288	602	1,130	2,330	3,490	6,720	10,700	18,900	38,600
900	279	584	1,100	2,260	3,380	6,520	10,400	18,400	37,400
950	271	567	1,070	2,190	3,290	6,330	10,100	17,800	36,400
1,000	264	551	1,040	2,130	3,200	6,150	9,810	17,300	35,400
1,100	250	524	987	2,030	3,030	5,840	9,320	16,500	33,600
1,200	239	500	941	1,930	2,900	5,580	8,890	15,700	32,000
1,300	229	478	901	1,850	2,770	5,340	8,510	15,000	30,700
1,400	220	460	866	1,780	2,660	5,130	8,180	14,500	29,500
1,500	212	443	834	1,710	2,570	4,940	7,880	13,900	28,400
1,600	205	428	806	1,650	2,480	4,770	7,610	13,400	27,400

1,700	198	414	780	1,600	2,400	4,620	7,360	13,000	26,500
1,800	192	401	756	1,550	2,330	4,480	7,140	12,600	25,700
1,900	186	390	734	1,510	2,260	4,350	6,930	12,300	25,000
2,000	181	379	714	1,470	2,200	4,230	6,740	11,900	24,300

Note: All table entries are rounded to 3 significant digits.

Table 6.2.1(h) Semirigid Copper Tubing

-	-	-	-	-	-	-	-	**Gas:**	**Natural**
-	-	-	-	-	-	-	-	**Inlet Pressure:**	**Less than 2 psi**
-	-	-	-	-	-	-	-	**Pressure Drop:**	**0.3 in. w.c.**
-	-	-	-	-	-	-	-	**Specific Gravity:**	**0.60**

-	-	**Tube Size (in.)**								
Nominal:	**K & L:**	¼	⅜	½	⅝	¾	1	1¼	1½	2
	ACR:	⅜	½	⅝	¾	⅞	1⅛	1⅜	—	—
Outside:		**0.375**	**0.500**	**0.625**	**0.750**	**0.875**	**1.125**	**1.375**	**1.625**	**2.125**
Inside:*		**0.305**	**0.402**	**0.527**	**0.652**	**0.745**	**0.995**	**1.245**	**1.481**	**1.959**
Length (ft)		**Capacity in Cubic Feet of Gas per Hour**								
10		20	42	85	148	210	448	806	1,270	2,650
20		14	29	58	102	144	308	554	873	1,820
30		11	23	47	82	116	247	445	701	1,460
40		10	20	40	70	99	211	381	600	1,250
50		NA	17	35	62	88	187	337	532	1,110
60		NA	16	32	56	79	170	306	482	1,000
70		NA	14	29	52	73	156	281	443	924
80		NA	13	27	48	68	145	262	413	859
90		NA	13	26	45	64	136	245	387	806
100		NA	12	24	43	60	129	232	366	761
125		NA	11	22	38	53	114	206	324	675
150		NA	10	20	34	48	103	186	294	612
175		NA	NA	18	31	45	95	171	270	563
200		NA	NA	17	29	41	89	159	251	523
250		NA	NA	15	26	37	78	141	223	464
300		NA	NA	13	23	33	71	128	202	420
350		NA	NA	12	22	31	65	118	186	387
400		NA	NA	11	20	28	61	110	173	360
450		NA	NA	11	19	27	57	103	162	338
500		NA	NA	10	18	25	54	97	153	319
550		NA	NA	NA	17	24	51	92	145	303
600		NA	NA	NA	16	23	49	88	139	289
650		NA	NA	NA	15	22	47	84	133	277
700		NA	NA	NA	15	21	45	81	128	266

750	NA	NA	NA	14	20	43	78	123	256
800	NA	NA	NA	14	20	42	75	119	247
850	NA	NA	NA	13	19	40	73	115	239
900	NA	NA	NA	13	18	39	71	111	232
950	NA	NA	NA	13	18	38	69	108	225
1,000	NA	NA	NA	12	17	37	67	105	219
1,100	NA	NA	NA	12	16	35	63	100	208
1,200	NA	NA	NA	11	16	34	60	95	199
1,300	NA	NA	NA	11	15	32	58	91	190
1,400	NA	NA	NA	10	14	31	56	88	183
1,500	NA	NA	NA	NA	14	30	54	84	176
1,600	NA	NA	NA	NA	13	29	52	82	170
1,700	NA	NA	NA	NA	13	28	50	79	164
1,800	NA	NA	NA	NA	13	27	49	77	159
1,900	NA	NA	NA	NA	12	26	47	74	155
2,000	NA	NA	NA	NA	12	25	46	72	151

NA: A flow of less than 10 cfh.

Note: All table entries are rounded to 3 significant digits.

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

Table 6.2.1(i) Semirigid Copper Tubing

-	-	-	-	-	-	-	**Gas:**	**Natural**		
-	-	-	-	-	-	-	**Inlet Pressure:**	**Less than 2 psi**		
-	-	-	-	-	-	-	**Pressure Drop:**	**0.5 in. w.c.**		
-	-	-	-	-	-	-	**Specific Gravity:**	**0.60**		
-	-	**Tube Size (in.)**								
Nominal:	**K & L:**	¼	⅜	½	⅝	¾	1	1¼	1½	2
	ACR:	⅜	½	⅝	¾	⅞	1⅛	1⅜	—	—
Outside:		0.375	0.500	0.625	0.750	0.875	1.125	1.375	1.625	2.125
Inside:*		0.305	0.402	0.527	0.652	0.745	0.995	1.245	1.481	1.959
Length (ft)		**Capacity in Cubic Feet of Gas per Hour**								
10		27	55	111	195	276	590	1,060	1,680	3,490
20		18	38	77	134	190	406	730	1,150	2,400
30		15	30	61	107	152	326	586	925	1,930
40		13	26	53	92	131	279	502	791	1,650
50		11	23	47	82	116	247	445	701	1,460
60		10	21	42	74	105	224	403	635	1,320
70		NA	19	39	68	96	206	371	585	1,220
80		NA	18	36	63	90	192	345	544	1,130
90		NA	17	34	59	84	180	324	510	1,060
100		NA	16	32	56	79	170	306	482	1,000
125		NA	14	28	50	70	151	271	427	890

Gas:	Natural
Inlet Pressure:	Less than 2 psi
Pressure Drop:	0.5 in. w.c.
Specific Gravity:	0.60

Nominal:		Tube Size (in.)								
	K & L:	¼	⅜	½	⅝	¾	1	1¼	1½	2
	ACR:	⅜	½	⅝	¾	⅞	1⅛	1⅜	—	—
Outside:		0.375	0.500	0.625	0.750	0.875	1.125	1.375	1.625	2.125
Inside:*		0.305	0.402	0.527	0.652	0.745	0.995	1.245	1.481	1.959
Length (ft)		Capacity in Cubic Feet of Gas per Hour								
150		NA	13	26	45	64	136	245	387	806
175		NA	12	24	41	59	125	226	356	742
200		NA	11	22	39	55	117	210	331	690
250		NA	NA	20	34	48	103	186	294	612
300		NA	NA	18	31	44	94	169	266	554
350		NA	NA	16	28	40	86	155	245	510
400		NA	NA	15	26	38	80	144	228	474
450		NA	NA	14	25	35	75	135	214	445
500		NA	NA	13	23	33	71	128	202	420
550		NA	NA	13	22	32	68	122	192	399
600		NA	NA	12	21	30	64	116	183	381
650		NA	NA	12	20	29	62	111	175	365
700		NA	NA	11	20	28	59	107	168	350
750		NA	NA	11	19	27	57	103	162	338
800		NA	NA	10	18	26	55	99	156	326
850		NA	NA	10	18	25	53	96	151	315
900		NA	NA	NA	17	24	52	93	147	306
950		NA	NA	NA	17	24	50	90	143	297
1,000		NA	NA	NA	16	23	49	88	139	289
1,100		NA	NA	NA	15	22	46	84	132	274
1,200		NA	NA	NA	15	21	44	80	126	262
1,300		NA	NA	NA	14	20	42	76	120	251
1,400		NA	NA	NA	13	19	41	73	116	241
1,500		NA	NA	NA	13	18	39	71	111	232
1,600		NA	NA	NA	13	18	38	68	108	224
1,700		NA	NA	NA	12	17	37	66	104	217
1,800		NA	NA	NA	12	17	36	64	101	210
1,900		NA	NA	NA	11	16	35	62	98	204
2,000		NA	NA	NA	11	16	34	60	95	199

NA: A flow of less than 10 cfh.

Note: All table entries are rounded to 3 significant digits.

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

Table 6.2.1(j) Semirigid Copper Tubing

Gas:	Natural
Inlet Pressure:	Less than 2 psi
Pressure Drop:	1.0 in. w.c.
Specific Gravity:	0.60

INTENDED USE: Tube Sizing Between House Line Regulator and the Appliance.

Nominal:	Tube Size (in.)								
K & L:	¼	⅜	½	⅝	¾	1	1¼	1½	2
ACR:	⅜	½	⅝	¾	⅞	1⅛	1⅜	—	—
Outside:	0.375	0.500	0.625	0.750	0.875	1.125	1.375	1.625	2.125
Inside:*	0.305	0.402	0.527	0.652	0.745	0.995	1.245	1.481	1.959
Length (ft)	Capacity in Cubic Feet of Gas per Hour								
10	39	80	162	283	402	859	1,550	2,440	5,080
20	27	55	111	195	276	590	1,060	1,680	3,490
30	21	44	89	156	222	474	853	1,350	2,800
40	18	38	77	134	190	406	730	1,150	2,400
50	16	33	68	119	168	359	647	1,020	2,130
60	15	30	61	107	152	326	586	925	1,930
70	13	28	57	99	140	300	539	851	1,770
80	13	26	53	92	131	279	502	791	1,650
90	12	24	49	86	122	262	471	742	1,550
100	11	23	47	82	116	247	445	701	1,460
125	NA	20	41	72	103	219	394	622	1,290
150	NA	18	37	65	93	198	357	563	1,170
175	NA	17	34	60	85	183	329	518	1,080
200	NA	16	32	56	79	170	306	482	1,000
250	NA	14	28	50	70	151	271	427	890
300	NA	13	26	45	64	136	245	387	806
350	NA	12	24	41	59	125	226	356	742
400	NA	11	22	39	55	117	210	331	690
450	NA	10	21	36	51	110	197	311	647
500	NA	NA	20	34	48	103	186	294	612
550	NA	NA	19	32	46	98	177	279	581
600	NA	NA	18	31	44	94	169	266	554
650	NA	NA	17	30	42	90	162	255	531
700	NA	NA	16	28	40	86	155	245	510
750	NA	NA	16	27	39	83	150	236	491
800	NA	NA	15	26	38	80	144	228	474
850	NA	NA	15	26	36	78	140	220	459
900	NA	NA	14	25	35	75	135	214	445
950	NA	NA	14	24	34	73	132	207	432
1,000	NA	NA	13	23	33	71	128	202	420
1,100	NA	NA	13	22	32	68	122	192	399

1,200	NA	NA	12	21	30	64	116	183	381
1,300	NA	NA	12	20	29	62	111	175	365
1,400	NA	NA	11	20	28	59	107	168	350
1,500	NA	NA	11	19	27	57	103	162	338
1,600	NA	NA	10	18	26	55	99	156	326
1,700	NA	NA	10	18	25	53	96	151	315
1,800	NA	NA	NA	17	24	52	93	147	306
1,900	NA	NA	NA	17	24	50	90	143	297
2,000	NA	NA	NA	16	23	49	88	139	289

NA: A flow of less than 10 cfh.

Note: All table entries are rounded to 3 significant digits.

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

Table 6.2.1(k) Semirigid Copper Tubing

							Gas:	Natural	
							Inlet Pressure:	Less than 2.0 psi	
							Pressure Drop:	17.0 in. w.c.	
							Specific Gravity:	0.60	
		Tube Size (in.)							
Nominal:	K & L:	¼	⅜	½	⅝	¾	1	1¼	1½	2
	ACR:	⅜	½	⅝	¾	⅞	1⅛	1⅜	—	—
Outside:		0.375	0.500	0.625	0.750	0.875	1.125	1.375	1.625	2.125
Inside:*		0.305	0.402	0.527	0.652	0.745	0.995	1.245	1.481	1.959
Length (ft)		Capacity in Cubic Feet of Gas per Hour								
10		190	391	796	1,390	1,970	4,220	7,590	12,000	24,900
20		130	269	547	956	1,360	2,900	5,220	8,230	17,100
30		105	216	439	768	1,090	2,330	4,190	6,610	13,800
40		90	185	376	657	932	1,990	3,590	5,650	11,800
50		79	164	333	582	826	1,770	3,180	5,010	10,400
60		72	148	302	528	749	1,600	2,880	4,540	9,460
70		66	137	278	486	689	1,470	2,650	4,180	8,700
80		62	127	258	452	641	1,370	2,460	3,890	8,090
90		58	119	243	424	601	1,280	2,310	3,650	7,590
100		55	113	229	400	568	1,210	2,180	3,440	7,170
125		48	100	203	355	503	1,080	1,940	3,050	6,360
150		44	90	184	321	456	974	1,750	2,770	5,760
175		40	83	169	296	420	896	1,610	2,540	5,300
200		38	77	157	275	390	834	1,500	2,370	4,930
250		33	69	140	244	346	739	1,330	2,100	4,370
300		30	62	126	221	313	670	1,210	1,900	3,960
350		28	57	116	203	288	616	1,110	1,750	3,640
400		26	53	108	189	268	573	1,030	1,630	3,390

								Gas:	Natural	
								Inlet Pressure:	Less than 2.0 psi	
								Pressure Drop:	17.0 in. w.c.	
								Specific Gravity:	0.60	
		Tube Size (in.)								
Nominal:	K & L:	¼	⅜	½	⅝	¾	1	1¼	1½	2
	ACR:	⅜	½	⅝	¾	⅞	1⅛	1⅜	—	—
Outside:		0.375	0.500	0.625	0.750	0.875	1.125	1.375	1.625	2.125
Inside:*		0.305	0.402	0.527	0.652	0.745	0.995	1.245	1.481	1.959
Length (ft)		Capacity in Cubic Feet of Gas per Hour								
450		24	50	102	177	252	538	968	1,530	3,180
500		23	47	96	168	238	508	914	1,440	3,000
550		22	45	91	159	226	482	868	1,370	2,850
600		21	43	87	152	215	460	829	1,310	2,720
650		20	41	83	145	206	441	793	1,250	2,610
700		19	39	80	140	198	423	762	1,200	2,500
750		18	38	77	135	191	408	734	1,160	2,410
800		18	37	74	130	184	394	709	1,120	2,330
850		17	35	72	126	178	381	686	1,080	2,250
900		17	34	70	122	173	370	665	1,050	2,180
950		16	33	68	118	168	359	646	1,020	2,120
1,000		16	32	66	115	163	349	628	991	2,060
1,100		15	31	63	109	155	332	597	941	1,960
1,200		14	29	60	104	148	316	569	898	1,870
1,300		14	28	57	100	142	303	545	860	1,790
1,400		13	27	55	96	136	291	524	826	1,720
1,500		13	26	53	93	131	280	505	796	1,660
1,600		12	25	51	89	127	271	487	768	1,600
1,700		12	24	49	86	123	262	472	744	1,550
1,800		11	24	48	84	119	254	457	721	1,500
1,900		11	23	47	81	115	247	444	700	1,460
2,000		11	22	45	79	112	240	432	681	1,420

Note: All table entries are rounded to 3 significant digits.

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

Table 6.2.1(l) Semirigid Copper Tubing

								Gas:	Natural	
								Inlet Pressure:	2.0 psi	
								Pressure Drop:	1.0 psi	
								Specific Gravity:	0.60	
		Tube Size (in.)								
Nominal:	K & L:	¼	⅜	½	⅝	¾	1	1¼	1½	2

ACR:	3/8	1/2	5/8	3/4	7/8	1 1/8	1 3/8	—	—
Outside:	0.375	0.500	0.625	0.750	0.875	1.125	1.375	1.625	2.125
Inside:*	0.305	0.402	0.527	0.652	0.745	0.995	1.245	1.481	1.959
Length (ft)	Capacity in Cubic Feet of Gas per Hour								
10	245	506	1,030	1,800	2,550	5,450	9,820	15,500	32,200
20	169	348	708	1,240	1,760	3,750	6,750	10,600	22,200
30	135	279	568	993	1,410	3,010	5,420	8,550	17,800
40	116	239	486	850	1,210	2,580	4,640	7,310	15,200
50	103	212	431	754	1,070	2,280	4,110	6,480	13,500
60	93	192	391	683	969	2,070	3,730	5,870	12,200
70	86	177	359	628	891	1,900	3,430	5,400	11,300
80	80	164	334	584	829	1,770	3,190	5,030	10,500
90	75	154	314	548	778	1,660	2,990	4,720	9,820
100	71	146	296	518	735	1,570	2,830	4,450	9,280
125	63	129	263	459	651	1,390	2,500	3,950	8,220
150	57	117	238	416	590	1,260	2,270	3,580	7,450
175	52	108	219	383	543	1,160	2,090	3,290	6,850
200	49	100	204	356	505	1,080	1,940	3,060	6,380
250	43	89	181	315	448	956	1,720	2,710	5,650
300	39	80	164	286	406	866	1,560	2,460	5,120
350	36	74	150	263	373	797	1,430	2,260	4,710
400	33	69	140	245	347	741	1,330	2,100	4,380
450	31	65	131	230	326	696	1,250	1,970	4,110
500	30	61	124	217	308	657	1,180	1,870	3,880
550	28	58	118	206	292	624	1,120	1,770	3,690
600	27	55	112	196	279	595	1,070	1,690	3,520
650	26	53	108	188	267	570	1,030	1,620	3,370
700	25	51	103	181	256	548	986	1,550	3,240
750	24	49	100	174	247	528	950	1,500	3,120
800	23	47	96	168	239	510	917	1,450	3,010
850	22	46	93	163	231	493	888	1,400	2,920
900	22	44	90	158	224	478	861	1,360	2,830
950	21	43	88	153	217	464	836	1,320	2,740
1,000	20	42	85	149	211	452	813	1,280	2,670
1,100	19	40	81	142	201	429	772	1,220	2,540
1,200	18	38	77	135	192	409	737	1,160	2,420
1,300	18	36	74	129	183	392	705	1,110	2,320
1,400	17	35	71	124	176	376	678	1,070	2,230
1,500	16	34	68	120	170	363	653	1,030	2,140
1,600	16	33	66	116	164	350	630	994	2,070
1,700	15	31	64	112	159	339	610	962	2,000
1,800	15	30	62	108	154	329	592	933	1,940
1,900	14	30	60	105	149	319	575	906	1,890
2,000	14	29	59	102	145	310	559	881	1,830

Note: All table entries are rounded to 3 significant digits.

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

Table 6.2.1(m) Semirigid Copper Tubing

Gas:	Natural
Inlet Pressure:	2.0 psi
Pressure Drop:	1.5 psi
Specific Gravity:	0.60

INTENDED USE: Pipe Sizing Between Point of Delivery and the House Line Regulator. Total Load Supplied by a Single House Line Regulator Not Exceeding 150 Cubic Feet per Hour.*

Nominal:	Tube Size (in.)								
K & L:	¼	⅜	½	⅝	¾	1	1¼	1½	2
ACR:	⅜	½	⅝	¾	⅞	1⅛	1⅜	—	—
Outside:	0.375	0.500	0.625	0.750	0.875	1.125	1.375	1.625	2.125
Inside:†	0.305	0.402	0.527	0.652	0.745	0.995	1.245	1.481	1.959
Length (ft)	Capacity in Cubic Feet of Gas per Hour								
10	303	625	1,270	2,220	3,150	6,740	12,100	19,100	39,800
20	208	430	874	1,530	2,170	4,630	8,330	13,100	27,400
30	167	345	702	1,230	1,740	3,720	6,690	10,600	22,000
40	143	295	601	1,050	1,490	3,180	5,730	9,030	18,800
50	127	262	532	931	1,320	2,820	5,080	8,000	16,700
60	115	237	482	843	1,200	2,560	4,600	7,250	15,100
70	106	218	444	776	1,100	2,350	4,230	6,670	13,900
80	98	203	413	722	1,020	2,190	3,940	6,210	12,900
90	92	190	387	677	961	2,050	3,690	5,820	12,100
100	87	180	366	640	907	1,940	3,490	5,500	11,500
125	77	159	324	567	804	1,720	3,090	4,880	10,200
150	70	144	294	514	729	1,560	2,800	4,420	9,200
175	64	133	270	472	670	1,430	2,580	4,060	8,460
200	60	124	252	440	624	1,330	2,400	3,780	7,870
250	53	110	223	390	553	1,180	2,130	3,350	6,980
300	48	99	202	353	501	1,070	1,930	3,040	6,320
350	44	91	186	325	461	984	1,770	2,790	5,820
400	41	85	173	302	429	916	1,650	2,600	5,410
450	39	80	162	283	402	859	1,550	2,440	5,080
500	36	75	153	268	380	811	1,460	2,300	4,800
550	35	72	146	254	361	771	1,390	2,190	4,560
600	33	68	139	243	344	735	1,320	2,090	4,350
650	32	65	133	232	330	704	1,270	2,000	4,160
700	30	63	128	223	317	676	1,220	1,920	4,000
750	29	60	123	215	305	652	1,170	1,850	3,850

800	28	58	119	208	295	629	1,130	1,790	3,720
850	27	57	115	201	285	609	1,100	1,730	3,600
900	27	55	111	195	276	590	1,060	1,680	3,490
950	26	53	108	189	268	573	1,030	1,630	3,390
1,000	25	52	105	184	261	558	1,000	1,580	3,300
1,100	24	49	100	175	248	530	954	1,500	3,130
1,200	23	47	95	167	237	505	910	1,430	2,990
1,300	22	45	91	160	227	484	871	1,370	2,860
1,400	21	43	88	153	218	465	837	1,320	2,750
1,500	20	42	85	148	210	448	806	1,270	2,650
1,600	19	40	82	143	202	432	779	1,230	2,560
1,700	19	39	79	138	196	419	753	1,190	2,470
1,800	18	38	77	134	190	406	731	1,150	2,400
1,900	18	37	74	130	184	394	709	1,120	2,330
2,000	17	36	72	126	179	383	690	1,090	2,270

Note: All table entries are rounded to 3 significant digits.

*When this table is used to size the tubing upstream of a line pressure regulator, the pipe or tubing downstream of the line pressure regulator shall be sized using a pressure drop no greater than 1 in. w.c.

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

Table 6.2.1(n) Semirigid Copper Tubing

							Gas:	Natural	
							Inlet Pressure:	5.0 psi	
							Pressure Drop:	3.5 psi	
							Specific Gravity:	0.60	
		Tube Size (in.)							
Nominal:	K & L:	¼	⅜	½	⅝	¾	1	1¼	1½	2
	ACR:	⅜	½	⅝	¾	⅞	1⅛	1⅜	—	—
Outside:		0.375	0.500	0.625	0.750	0.875	1.125	1.375	1.625	2.125
Inside:*		0.305	0.402	0.527	0.652	0.745	0.995	1.245	1.481	1.959
Length (ft)		Capacity in Cubic Feet of Gas per Hour								
10		511	1,050	2,140	3,750	5,320	11,400	20,400	32,200	67,100
20		351	724	1,470	2,580	3,650	7,800	14,000	22,200	46,100
30		282	582	1,180	2,070	2,930	6,270	11,300	17,800	37,000
40		241	498	1,010	1,770	2,510	5,360	9,660	15,200	31,700
50		214	441	898	1,570	2,230	4,750	8,560	13,500	28,100
60		194	400	813	1,420	2,020	4,310	7,750	12,200	25,500
70		178	368	748	1,310	1,860	3,960	7,130	11,200	23,400
80		166	342	696	1,220	1,730	3,690	6,640	10,500	21,800
90		156	321	653	1,140	1,620	3,460	6,230	9,820	20,400
100		147	303	617	1,080	1,530	3,270	5,880	9,270	19,300
125		130	269	547	955	1,360	2,900	5,210	8,220	17,100

								Gas:	Natural	
								Inlet Pressure:	5.0 psi	
								Pressure Drop:	3.5 psi	
								Specific Gravity:	0.60	
		Tube Size (in.)								
Nominal:	K & L:	¼	⅜	½	⅝	¾	1	1¼	1½	2
	ACR:	⅜	½	⅝	¾	⅞	1⅛	1⅜	—	—
Outside:		0.375	0.500	0.625	0.750	0.875	1.125	1.375	1.625	2.125
Inside:*		0.305	0.402	0.527	0.652	0.745	0.995	1.245	1.481	1.959
Length (ft)		Capacity in Cubic Feet of Gas per Hour								
150		118	243	495	866	1,230	2,620	4,720	7,450	15,500
175		109	224	456	796	1,130	2,410	4,350	6,850	14,300
200		101	208	424	741	1,050	2,250	4,040	6,370	13,300
250		90	185	376	657	932	1,990	3,580	5,650	11,800
300		81	167	340	595	844	1,800	3,250	5,120	10,700
350		75	154	313	547	777	1,660	2,990	4,710	9,810
400		69	143	291	509	722	1,540	2,780	4,380	9,120
450		65	134	273	478	678	1,450	2,610	4,110	8,560
500		62	127	258	451	640	1,370	2,460	3,880	8,090
550		58	121	245	429	608	1,300	2,340	3,690	7,680
600		56	115	234	409	580	1,240	2,230	3,520	7,330
650		53	110	224	392	556	1,190	2,140	3,370	7,020
700		51	106	215	376	534	1,140	2,050	3,240	6,740
750		49	102	207	362	514	1,100	1,980	3,120	6,490
800		48	98	200	350	497	1,060	1,910	3,010	6,270
850		46	95	194	339	481	1,030	1,850	2,910	6,070
900		45	92	188	328	466	1,000	1,790	2,820	5,880
950		43	90	182	319	452	967	1,740	2,740	5,710
1,000		42	87	177	310	440	940	1,690	2,670	5,560
1,100		40	83	169	295	418	893	1,610	2,530	5,280
1,200		38	79	161	281	399	852	1,530	2,420	5,040
1,300		37	76	154	269	382	816	1,470	2,320	4,820
1,400		35	73	148	259	367	784	1,410	2,220	4,630
1,500		34	70	143	249	353	755	1,360	2,140	4,460
1,600		33	68	138	241	341	729	1,310	2,070	4,310
1,700		32	65	133	233	330	705	1,270	2,000	4,170
1,800		31	63	129	226	320	684	1,230	1,940	4,040
1,900		30	62	125	219	311	664	1,200	1,890	3,930
2,000		29	60	122	213	302	646	1,160	1,830	3,820

Note: All table entries are rounded to 3 significant digits.

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

Table 6.2.1(o) Corrugated Stainless Steel Tubing (CSST)

-	-	-	-	-	-	-	-	-	-	-	Gas:	Natural		
-	-	-	-	-	-	-	-	-	-	-	Inlet Pressure:	Less than 2 psi		
-	-	-	-	-	-	-	-	-	-	-	Pressure Drop:	0.5 in. w.c.		
-	-	-	-	-	-	-	-	-	-	-	Specific Gravity:	0.60		

-	Tube Size (EHD)													
Flow Designation:	13	15	18	19	23	25	30	31	37	39	46	48	60	62
Length (ft)	Capacity in Cubic Feet of Gas per Hour													
5	46	63	115	134	225	270	471	546	895	1,037	1,790	2,070	3,660	4,140
10	32	44	82	95	161	192	330	383	639	746	1,260	1,470	2,600	2,930
15	25	35	66	77	132	157	267	310	524	615	1,030	1,200	2,140	2,400
20	22	31	58	67	116	137	231	269	456	536	888	1,050	1,850	2,080
25	19	27	52	60	104	122	206	240	409	482	793	936	1,660	1,860
30	18	25	47	55	96	112	188	218	374	442	723	856	1,520	1,700
40	15	21	41	47	83	97	162	188	325	386	625	742	1,320	1,470
50	13	19	37	42	75	87	144	168	292	347	559	665	1,180	1,320
60	12	17	34	38	68	80	131	153	267	318	509	608	1,080	1,200
70	11	16	31	36	63	74	121	141	248	295	471	563	1,000	1,110
80	10	15	29	33	60	69	113	132	232	277	440	527	940	1,040
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	148	226	275	492	540

EHD: Equivalent hydraulic diameter. 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.

Notes:

(1) Table includes losses for four 90 degree bends and two end fittings. Tubing runs with larger numbers of bends and/or fittings 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 and/or bends.

(2) All table entries are rounded to 3 significant digits.

Table 6.2.1(p) Corrugated Stainless Steel Tubing (CSST)

-	-	-	-	-	-	-	-	-	-	-	Gas:	Natural	
-	-	-	-	-	-	-	-	-	-	-	Inlet Pressure:	Less than 2 psi	
-	-	-	-	-	-	-	-	-	-	-	Pressure Drop:	3.0 in. w.c.	
-	-	-	-	-	-	-	-	-	-	-	Specific Gravity:	0.60	

INTENDED USE: Initial Supply Pressure of 8.0 in. w.c. or Greater.

	Tube Size (EHD)													
Flow Designation:	13	15	18	19	23	25	30	31	37	39	46	48	60	62
Length (ft)	Capacity in Cubic Feet of Gas per Hour													
5	120	160	277	327	529	649	1,180	1,370	2,140	2423	4,430	5,010	8,800	10,100
10	83	112	197	231	380	462	828	958	1,530	1740	3,200	3,560	6,270	7,160
15	67	90	161	189	313	379	673	778	1,250	1433	2,540	2,910	5,140	5,850
20	57	78	140	164	273	329	580	672	1,090	1249	2,200	2,530	4,460	5,070
25	51	69	125	147	245	295	518	599	978	1123	1,960	2,270	4,000	4,540
30	46	63	115	134	225	270	471	546	895	1029	1,790	2,070	3,660	4,140
40	39	54	100	116	196	234	407	471	778	897	1,550	1,800	3,180	3,590
50	35	48	89	104	176	210	363	421	698	806	1,380	1,610	2,850	3,210
60	32	44	82	95	161	192	330	383	639	739	1,260	1,470	2,600	2,930
70	29	41	76	88	150	178	306	355	593	686	1,170	1,360	2,420	2,720
80	27	38	71	82	141	167	285	331	555	644	1,090	1,280	2,260	2,540
90	26	36	67	77	133	157	268	311	524	609	1,030	1,200	2,140	2,400
100	24	34	63	73	126	149	254	295	498	579	974	1,140	2,030	2,280
150	19	27	52	60	104	122	206	240	409	477	793	936	1,660	1,860
200	17	23	45	52	91	106	178	207	355	415	686	812	1,440	1,610
250	15	21	40	46	82	95	159	184	319	373	613	728	1,290	1,440
300	13	19	37	42	75	87	144	168	234	342	559	665	1,180	1,320

EHD: Equivalent hydraulic diameter. 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.

Notes:

(1) Table includes losses for four 90 degree bends and two end fittings. Tubing runs with larger numbers of bends and/or fittings 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 and/or bends.

(2) All table entries are rounded to 3 significant digits.

Table 6.2.1(q) Corrugated Stainless Steel Tubing (CSST)

Gas:	Natural
Inlet Pressure:	Less than 2 psi
Pressure Drop:	6.0 in. w.c.
Specific Gravity:	0.60

INTENDED USE: Initial Supply Pressure of 11.0 in. w.c. or Greater.

	Tube Size (EHD)													
Flow Designation:	13	15	18	19	23	25	30	31	37	39	46	48	60	62
Length (ft)	Capacity in Cubic Feet of Gas per Hour													
5	173	229	389	461	737	911	1,690	1,950	3,000	3375	6,280	7,050	12,400	14,260

Gas:	Natural
Inlet Pressure:	Less than 2 psi
Pressure Drop:	6.0 in. w.c.
Specific Gravity:	0.60

INTENDED USE: Initial Supply Pressure of 11.0 in. w.c. or Greater.

	Tube Size (EHD)													
Flow Designation:	13	15	18	19	23	25	30	31	37	39	46	48	60	62
Length (ft)	Capacity in Cubic Feet of Gas per Hour													
10	120	160	277	327	529	649	1,180	1,370	2,140	2423	4,430	5,010	8,800	10,100
15	96	130	227	267	436	532	960	1,110	1,760	1996	3,610	4,100	7,210	8,260
20	83	112	197	231	380	462	828	958	1,530	1740	3,120	3,560	6,270	7,160
25	74	99	176	207	342	414	739	855	1,370	1564	2,790	3,190	5,620	6,400
30	67	90	161	189	313	379	673	778	1,250	1433	2,540	2,910	5,140	5,850
40	57	78	140	164	273	329	580	672	1,090	1249	2,200	2,530	4,460	5,070
50	51	69	125	147	245	295	518	599	978	1123	1,960	2,270	4,000	4,540
60	46	63	115	134	225	270	471	546	895	1029	1,790	2,070	3,660	4,140
70	42	58	106	124	209	250	435	505	830	956	1,660	1,920	3,390	3,840
80	39	54	100	116	196	234	407	471	778	897	1,550	1,800	3,180	3,590
90	37	51	94	109	185	221	383	444	735	848	1,460	1,700	3,000	3,390
100	35	48	89	104	176	210	363	421	698	806	1,380	1,610	2,850	3,210
150	28	39	73	85	145	172	294	342	573	664	1,130	1,320	2,340	2,630
200	24	34	63	73	126	149	254	295	498	579	974	1,140	2,030	2,280
250	21	30	57	66	114	134	226	263	447	520	870	1,020	1,820	2,040
300	19	27	52	60	104	122	206	240	409	477	793	936	1,660	1,860

EHD: Equivalent hydraulic diameter. 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.

Notes:

(1) Table includes losses for four 90 degree bends and two end fittings. Tubing runs with larger numbers of bends and/or fittings 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 and/or bends.

(2) All table entries are rounded to 3 significant digits.

Table 6.2.1(r) Corrugated Stainless Steel Tubing (CSST)

Gas:	Natural
Inlet Pressure:	2.0 psi
Pressure Drop:	1.0 psi
Specific Gravity:	0.60

	Tube Size (EHD)

Flow Designation:	13	15	18	19	23	25	30	31	37	39	46	48	60	62
Length (ft)	Capacity in Cubic Feet of Gas per Hour													
10	270	353	587	700	1,100	1,370	2,590	2,990	4,510	5,037	9,600	10,700	18,600	21,600
25	166	220	374	444	709	876	1,620	1,870	2,890	3,258	6,040	6,780	11,900	13,700
30	151	200	342	405	650	801	1,480	1,700	2,640	2,987	5,510	6,200	10,900	12,500
40	129	172	297	351	567	696	1,270	1,470	2,300	2,605	4,760	5,380	9,440	10,900
50	115	154	266	314	510	624	1,140	1,310	2,060	2,343	4,260	4,820	8,470	9,720
75	93	124	218	257	420	512	922	1,070	1,690	1,932	3,470	3,950	6,940	7,940
80	89	120	211	249	407	496	892	1,030	1,640	1,874	3,360	3,820	6,730	7,690
100	79	107	189	222	366	445	795	920	1,470	1,685	3,000	3,420	6,030	6,880
150	64	87	155	182	302	364	646	748	1,210	1,389	2,440	2,800	4,940	5,620
200	55	75	135	157	263	317	557	645	1,050	1,212	2,110	2,430	4,290	4,870
250	49	67	121	141	236	284	497	576	941	1,090	1,890	2,180	3,850	4,360
300	44	61	110	129	217	260	453	525	862	999	1,720	1,990	3,520	3,980
400	38	52	96	111	189	225	390	453	749	871	1,490	1,730	3,060	3,450
500	34	46	86	100	170	202	348	404	552	783	1,330	1,550	2,740	3,090

EHD: Equivalent hydraulic diameter. 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.

Notes:

(1) Table does not include effect of pressure drop across the line regulator. Where regulator loss exceeds ¾ psi, do not use this table. Consult with regulator manufacturer for pressure drops and capacity factors. Pressure drops across a regulator may vary with flow rate.

(2) CAUTION: Capacities shown in table may exceed maximum capacity for a selected regulator. Consult with regulator or tubing manufacturer for guidance.

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

(4) All table entries are rounded to 3 significant digits.

Table 6.2.1(s) Corrugated Stainless Steel Tubing (CSST)

-	-	-	-	-	-	-	-	-	-	-	Gas:	Natural
-	-	-	-	-	-	-	-	-	-	-	Inlet Pressure:	5.0 psi
-	-	-	-	-	-	-	-	-	-	-	Pressure Drop:	3.5 psi
-	-	-	-	-	-	-	-	-	-	-	Specific Gravity:	0.60

-	Tube Size (EHD)													
Flow Designation:	13	15	18	19	23	25	30	31	37	39	46	48	60	6
Length (ft)	Capacity in Cubic Feet of Gas per Hour													
10	523	674	1,080	1,300	2,000	2,530	4,920	5,660	8,300	9,140	18,100	19,800	34,400	40,
25	322	420	691	827	1,290	1,620	3,080	3,540	5,310	5,911	11,400	12,600	22,000	25,
30	292	382	632	755	1,180	1,480	2,800	3,230	4,860	5,420	10,400	11,500	20,100	23,

Gas:	Natural
Inlet Pressure:	5.0 psi
Pressure Drop:	3.5 psi
Specific Gravity:	0.60

	Tube Size (EHD)													
Flow Designation:	13	15	18	19	23	25	30	31	37	39	46	48	60	6
Length (ft)	Capacity in Cubic Feet of Gas per Hour													
40	251	329	549	654	1,030	1,280	2,420	2,790	4,230	4,727	8,970	10,000	17,400	20,:
50	223	293	492	586	926	1,150	2,160	2,490	3,790	4,251	8,020	8,930	15,600	18,
75	180	238	403	479	763	944	1,750	2,020	3,110	3,506	6,530	7,320	12,800	14,(
80	174	230	391	463	740	915	1,690	1,960	3,020	3,400	6,320	7,090	12,400	14,:
100	154	205	350	415	665	820	1,510	1,740	2,710	3,057	5,650	6,350	11,100	12,(
150	124	166	287	339	548	672	1,230	1,420	2,220	2,521	4,600	5,200	9,130	10,:
200	107	143	249	294	478	584	1,060	1,220	1,930	2,199	3,980	4,510	7,930	9,0
250	95	128	223	263	430	524	945	1,090	1,730	1,977	3,550	4,040	7,110	8,1
300	86	116	204	240	394	479	860	995	1,590	1,813	3,240	3,690	6,500	7,4
400	74	100	177	208	343	416	742	858	1,380	1,581	2,800	3,210	5,650	6,4
500	66	89	159	186	309	373	662	766	1,040	1,422	2,500	2,870	5,060	5,7

EHD: Equivalent hydraulic diameter. 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.

Notes:

(1) Table does not include effect of pressure drop across line regulator. Where regulator loss exceeds 1 psi, do not use this table. Consult with regulator manufacturer for pressure drops and capacity factors. Pressure drop across regulator may vary with the flow rate.

(2) CAUTION: Capacities shown in table may exceed maximum capacity of selected regulator. Consult with tubing manufacturer for guidance.

(3) Table includes losses for four 90 degree bends and two end fittings. Tubing runs with larger numbers of bends and/or fittings 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 and/or bends.

(4) All table entries are rounded to 3 significant digits.

Table 6.2.1(t) Polyethylene Plastic Pipe

Gas:	Natural
Inlet Pressure:	Less than 2 psi
Pressure Drop:	0.3 in. w.c.
Specific Gravity:	0.60

	Pipe Size (in.)							
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 (ft)	Capacity in Cubic Feet of Gas per Hour							
10	153	305	551	955	1,440	2,590	7,170	13,900
20	105	210	379	656	991	1,780	4,920	9,520
30	84	169	304	527	796	1,430	3,950	7,640
40	72	144	260	451	681	1,220	3,380	6,540
50	64	128	231	400	604	1,080	3,000	5,800
60	58	116	209	362	547	983	2,720	5,250
70	53	107	192	333	503	904	2,500	4,830
80	50	99	179	310	468	841	2,330	4,500
90	46	93	168	291	439	789	2,180	4,220
100	44	88	159	275	415	745	2,060	3,990
125	39	78	141	243	368	661	1,830	3,530
150	35	71	127	221	333	598	1,660	3,200
175	32	65	117	203	306	551	1,520	2,940
200	30	60	109	189	285	512	1,420	2,740
250	27	54	97	167	253	454	1,260	2,430
300	24	48	88	152	229	411	1,140	2,200
350	22	45	81	139	211	378	1,050	2,020
400	21	42	75	130	196	352	974	1,880
450	19	39	70	122	184	330	914	1,770
500	18	37	66	115	174	312	863	1,670

Note: All table entries are rounded to 3 significant digits.

Table 6.2.1(u) Polyethylene Plastic Pipe

-	-	-	Gas:	Natural
-	-	-	Inlet Pressure:	Less than 2 psi
-	-	-	Pressure Drop:	0.5 in. w.c.
-	-	-	Specific Gravity:	0.60

-	Pipe Size (in.)							
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 (ft)	Capacity in Cubic Feet of Gas per Hour							
10	201	403	726	1,260	1,900	3,410	9,450	18,260
20	138	277	499	865	1,310	2,350	6,490	12,550
30	111	222	401	695	1,050	1,880	5,210	10,080
40	95	190	343	594	898	1,610	4,460	8,630
50	84	169	304	527	796	1,430	3,950	7,640
60	76	153	276	477	721	1,300	3,580	6,930
70	70	140	254	439	663	1,190	3,300	6,370
80	65	131	236	409	617	1,110	3,070	5,930
90	61	123	221	383	579	1,040	2,880	5,560
100	58	116	209	362	547	983	2,720	5,250

-	-	-	Gas:	Natural
-	-	-	Inlet Pressure:	Less than 2 psi
-	-	-	Pressure Drop:	0.5 in. w.c.
-	-	-	Specific Gravity:	0.60

-	Pipe Size (in.)							
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 (ft)	Capacity in Cubic Feet of Gas per Hour							
125	51	103	185	321	485	871	2,410	4,660
150	46	93	168	291	439	789	2,180	4,220
175	43	86	154	268	404	726	2,010	3,880
200	40	80	144	249	376	675	1,870	3,610
250	35	71	127	221	333	598	1,660	3,200
300	32	64	115	200	302	542	1,500	2,900
350	29	59	106	184	278	499	1,380	2,670
400	27	55	99	171	258	464	1,280	2,480
450	26	51	93	160	242	435	1,200	2,330
500	24	48	88	152	229	411	1,140	2,200

Note: All table entries are rounded to 3 significant digits.

Table 6.2.1(v) Polyethylene Plastic Pipe

-	-	-	Gas:	Natural
-	-	-	Inlet Pressure:	2.0 psi
-	-	-	Pressure Drop:	1.0 psi
-	-	-	Specific Gravity:	0.60

-	Pipe Size (in.)							
Nominal OD:	½	¾	1	1¼	1½	2	3	3
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 (ft)	Capacity in Cubic Feet of Gas per Hour							
10	1,860	3,720	6,710	11,600	17,600	31,600	87,300	169,000
20	1,280	2,560	4,610	7,990	12,100	21,700	60,000	116,000
30	1,030	2,050	3,710	6,420	9,690	17,400	48,200	93,200
40	878	1,760	3,170	5,490	8,300	14,900	41,200	79,700
50	778	1,560	2,810	4,870	7,350	13,200	36,600	70,700
60	705	1,410	2,550	4,410	6,660	12,000	33,100	64,000
70	649	1,300	2,340	4,060	6,130	11,000	30,500	58,900
80	603	1,210	2,180	3,780	5,700	10,200	28,300	54,800
90	566	1,130	2,050	3,540	5,350	9,610	26,600	51,400
100	535	1,070	1,930	3,350	5,050	9,080	25,100	48,600
125	474	949	1,710	2,970	4,480	8,050	22,300	43,000

-	-	-	Gas:	Natural				
-	-	-	Inlet Pressure:	2.0 psi				
-	-	-	Pressure Drop:	1.0 psi				
-	-	-	Specific Gravity:	0.60				

-	Pipe Size (in.)							
Nominal OD:	½	¾	1	1¼	1½	2	3	3
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 (ft)	Capacity in Cubic Feet of Gas per Hour							
150	429	860	1,550	2,690	4,060	7,290	20,200	39,000
175	395	791	1,430	2,470	3,730	6,710	18,600	35,900
200	368	736	1,330	2,300	3,470	6,240	17,300	33,400
250	326	652	1,180	2,040	3,080	5,530	15,300	29,600
300	295	591	1,070	1,850	2,790	5,010	13,900	26,800
350	272	544	981	1,700	2,570	4,610	12,800	24,700
400	253	506	913	1,580	2,390	4,290	11,900	22,900
450	237	475	856	1,480	2,240	4,020	11,100	21,500
500	224	448	809	1,400	2,120	3,800	10,500	20,300
550	213	426	768	1,330	2,010	3,610	9,990	19,300
600	203	406	733	1,270	1,920	3,440	9,530	18,400
650	194	389	702	1,220	1,840	3,300	9,130	17,600
700	187	374	674	1,170	1,760	3,170	8,770	16,900
750	180	360	649	1,130	1,700	3,050	8,450	16,300
800	174	348	627	1,090	1,640	2,950	8,160	15,800
850	168	336	607	1,050	1,590	2,850	7,890	15,300
900	163	326	588	1,020	1,540	2,770	7,650	14,800
950	158	317	572	990	1,500	2,690	7,430	14,400
1,000	154	308	556	963	1,450	2,610	7,230	14,000
1,100	146	293	528	915	1,380	2,480	6,870	13,300
1,200	139	279	504	873	1,320	2,370	6,550	12,700
1,300	134	267	482	836	1,260	2,270	6,270	12,100
1,400	128	257	463	803	1,210	2,180	6,030	11,600
1,500	124	247	446	773	1,170	2,100	5,810	11,200
1,600	119	239	431	747	1,130	2,030	5,610	10,800
1,700	115	231	417	723	1,090	1,960	5,430	10,500
1,800	112	224	404	701	1,060	1,900	5,260	10,200
1,900	109	218	393	680	1,030	1,850	5,110	9,900
2,000	106	212	382	662	1,000	1,800	4,970	9,600

Note: All table entries are rounded to 3 significant digits.

Table 6.2.1(w) Polyethylene Plastic Tubing

-		
-	Gas:	Natural
	Inlet Pressure:	Less than 2.0 psi

-	Pressure Drop:	0.3 in. w.c.
-	Specific Gravity:	0.60
-	Plastic Tubing Size (CTS) (in.)	
Nominal OD:	½	1
Designation:	SDR 7	SDR 11
Actual ID:	0.445	0.927
Length (ft)	Capacity in Cubic Feet of Gas per Hour	
10	54	372
20	37	256
30	30	205
40	26	176
50	23	156
60	21	141
70	19	130
80	18	121
90	17	113
100	16	107
125	14	95
150	13	86
175	12	79
200	11	74
225	10	69
250	NA	65
275	NA	62
300	NA	59
350	NA	54
400	NA	51
450	NA	47
500	NA	45

CTS: Copper tube size.

NA: A flow of less than 10 cfh.

Note: All table entries are rounded to 3 significant digits.

Table 6.2.1(x) Polyethylene Plastic Tubing

-	Gas:	Natural
-	Inlet Pressure:	Less than 2.0 psi
-	Pressure Drop:	0.5 in. w.c.
-	Specific Gravity:	0.60
-	Plastic Tubing Size (CTS) (in.)	
Nominal OD:	½	1
Designation:	SDR 7	SDR 11
Actual ID:	0.445	0.927

Length (ft)	Capacity in Cubic Feet of Gas per Hour	
10	72	490
20	49	337
30	39	271
40	34	232
50	30	205
60	27	186
70	25	171
80	23	159
90	22	149
100	21	141
125	18	125
150	17	113
175	15	104
200	14	97
225	13	91
250	12	86
275	11	82
300	11	78
350	10	72
400	NA	67
450	NA	63
500	NA	59

CTS: Copper tube size.

NA: A flow of less than 10 cfh.

Note: All table entries are rounded to 3 significant digits.

6.2.2

Section 6.4 shall be used in conjunction with one of the methods described in 6.1.2 through 6.1.4 for non-corrugated stainless steel tubing.

6.3 Sizing Propane Piping Systems.

Sizing of piping systems shall be in accordance with 6.3.1 or 6.3.2.

6.3.1

Table 6.3.1(a) through Table 6.3.1(m) shall be used in conjunction with one of the methods described in 6.1.2 through 6.1.4 for piping materials other than non-corrugated stainless steel tubing.

Table 6.3.1(a) Schedule 40 Metallic Pipe

Gas:	Undiluted Propane
Inlet Pressure:	10.0 psi
Pressure Drop:	1.0 psi
Specific Gravity:	1.50

INTENDED USE: Pipe Sizing Between First-Stage (High-Pressure) Regulator and Second-Stage (Low-Pressure) Regulator.

	Pipe Size (in.)								
Nominal Inside:	½	¾	1	1¼	1½	2	2½	3	4
Actual:	0.622	0.824	1.049	1.380	1.610	2.067	2.469	3.068	4.026
Length (ft)	Capacity in Thousands of Btu per Hour								
10	3,320	6,950	13,100	26,900	40,300	77,600	124,000	219,000	446,000
20	2,280	4,780	9,000	18,500	27,700	53,300	85,000	150,000	306,000
30	1,830	3,840	7,220	14,800	22,200	42,800	68,200	121,000	246,000
40	1,570	3,280	6,180	12,700	19,000	36,600	58,400	103,000	211,000
50	1,390	2,910	5,480	11,300	16,900	32,500	51,700	91,500	187,000
60	1,260	2,640	4,970	10,200	15,300	29,400	46,900	82,900	169,000
70	1,160	2,430	4,570	9,380	14,100	27,100	43,100	76,300	156,000
80	1,080	2,260	4,250	8,730	13,100	25,200	40,100	70,900	145,000
90	1,010	2,120	3,990	8,190	12,300	23,600	37,700	66,600	136,000
100	956	2,000	3,770	7,730	11,600	22,300	35,600	62,900	128,000
125	848	1,770	3,340	6,850	10,300	19,800	31,500	55,700	114,000
150	768	1,610	3,020	6,210	9,300	17,900	28,600	50,500	103,000
175	706	1,480	2,780	5,710	8,560	16,500	26,300	46,500	94,700
200	657	1,370	2,590	5,320	7,960	15,300	24,400	43,200	88,100
250	582	1,220	2,290	4,710	7,060	13,600	21,700	38,300	78,100
300	528	1,100	2,080	4,270	6,400	12,300	19,600	34,700	70,800
350	486	1,020	1,910	3,930	5,880	11,300	18,100	31,900	65,100
400	452	945	1,780	3,650	5,470	10,500	16,800	29,700	60,600
450	424	886	1,670	3,430	5,140	9,890	15,800	27,900	56,800
500	400	837	1,580	3,240	4,850	9,340	14,900	26,300	53,700
550	380	795	1,500	3,070	4,610	8,870	14,100	25,000	51,000
600	363	759	1,430	2,930	4,400	8,460	13,500	23,900	48,600
650	347	726	1,370	2,810	4,210	8,110	12,900	22,800	46,600
700	334	698	1,310	2,700	4,040	7,790	12,400	21,900	44,800
750	321	672	1,270	2,600	3,900	7,500	12,000	21,100	43,100
800	310	649	1,220	2,510	3,760	7,240	11,500	20,400	41,600
850	300	628	1,180	2,430	3,640	7,010	11,200	19,800	40,300
900	291	609	1,150	2,360	3,530	6,800	10,800	19,200	39,100

950	283	592	1,110	2,290	3,430	6,600	10,500	18,600	37,900
1,000	275	575	1,080	2,230	3,330	6,420	10,200	18,100	36,900
1,100	261	546	1,030	2,110	3,170	6,100	9,720	17,200	35,000
1,200	249	521	982	2,020	3,020	5,820	9,270	16,400	33,400
1,300	239	499	940	1,930	2,890	5,570	8,880	15,700	32,000
1,400	229	480	903	1,850	2,780	5,350	8,530	15,100	30,800
1,500	221	462	870	1,790	2,680	5,160	8,220	14,500	29,600
1,600	213	446	840	1,730	2,590	4,980	7,940	14,000	28,600
1,700	206	432	813	1,670	2,500	4,820	7,680	13,600	27,700
1,800	200	419	789	1,620	2,430	4,670	7,450	13,200	26,900
1,900	194	407	766	1,570	2,360	4,540	7,230	12,800	26,100
2,000	189	395	745	1,530	2,290	4,410	7,030	12,400	25,400

Note: All table entries are rounded to 3 significant digits.

Table 6.3.1(b) Schedule 40 Metallic Pipe

-	-	-	-	-	-	**Gas:**	**Undiluted Propane**
-	-	-	-	-	-	**Inlet Pressure:**	**10.0 psi**
-	-	-	-	-	-	**Pressure Drop:**	**3.0 psi**
-	-	-	-	-	-	**Specific Gravity:**	**1.50**

INTENDED USE: Pipe Sizing Between First-Stage (High-Pressure) Regulator and Second-Stage (Low-Pressure) Regulator.

-	Pipe Size (in.)								
Nominal Inside:	½	¾	1	1¼	1½	2	2½	3	4
Actual:	**0.622**	**0.824**	**1.049**	**1.380**	**1.610**	**2.067**	**2.469**	**3.068**	**4.026**
Length (ft)	**Capacity in Thousands of Btu per Hour**								
10	5,890	12,300	23,200	47,600	71,300	137,000	219,000	387,000	789,000
20	4,050	8,460	15,900	32,700	49,000	94,400	150,000	266,000	543,000
30	3,250	6,790	12,800	26,300	39,400	75,800	121,000	214,000	436,000
40	2,780	5,810	11,000	22,500	33,700	64,900	103,000	183,000	373,000
50	2,460	5,150	9,710	19,900	29,900	57,500	91,600	162,000	330,000
60	2,230	4,670	8,790	18,100	27,100	52,100	83,000	147,000	299,000
70	2,050	4,300	8,090	16,600	24,900	47,900	76,400	135,000	275,000
80	1,910	4,000	7,530	15,500	23,200	44,600	71,100	126,000	256,000
90	1,790	3,750	7,060	14,500	21,700	41,800	66,700	118,000	240,000
100	1,690	3,540	6,670	13,700	20,500	39,500	63,000	111,000	227,000
125	1,500	3,140	5,910	12,100	18,200	35,000	55,800	98,700	201,000
150	1,360	2,840	5,360	11,000	16,500	31,700	50,600	89,400	182,000
175	1,250	2,620	4,930	10,100	15,200	29,200	46,500	82,300	167,800
200	1,160	2,430	4,580	9,410	14,100	27,200	43,300	76,500	156,100
250	1,030	2,160	4,060	8,340	12,500	24,100	38,400	67,800	138,400
300	935	1,950	3,680	7,560	11,300	21,800	34,800	61,500	125,400
350	860	1,800	3,390	6,950	10,400	20,100	32,000	56,500	115,300

Gas:	Undiluted Propane
Inlet Pressure:	10.0 psi
Pressure Drop:	3.0 psi
Specific Gravity:	1.50

INTENDED USE: Pipe Sizing Between First-Stage (High-Pressure) Regulator and Second-Stage (Low-Pressure) Regulator.

	Pipe Size (in.)								
Nominal Inside:	½	¾	1	1¼	1½	2	2½	3	4
Actual:	0.622	0.824	1.049	1.380	1.610	2.067	2.469	3.068	4.026
Length (ft)	Capacity in Thousands of Btu per Hour								
400	800	1,670	3,150	6,470	9,690	18,700	29,800	52,600	107,300
450	751	1,570	2,960	6,070	9,090	17,500	27,900	49,400	100,700
500	709	1,480	2,790	5,730	8,590	16,500	26,400	46,600	95,100
550	673	1,410	2,650	5,450	8,160	15,700	25,000	44,300	90,300
600	642	1,340	2,530	5,200	7,780	15,000	23,900	42,200	86,200
650	615	1,290	2,420	4,980	7,450	14,400	22,900	40,500	82,500
700	591	1,240	2,330	4,780	7,160	13,800	22,000	38,900	79,300
750	569	1,190	2,240	4,600	6,900	13,300	21,200	37,400	76,400
800	550	1,150	2,170	4,450	6,660	12,800	20,500	36,200	73,700
850	532	1,110	2,100	4,300	6,450	12,400	19,800	35,000	71,400
900	516	1,080	2,030	4,170	6,250	12,000	19,200	33,900	69,200
950	501	1,050	1,970	4,050	6,070	11,700	18,600	32,900	67,200
1,000	487	1,020	1,920	3,940	5,900	11,400	18,100	32,000	65,400
1,100	463	968	1,820	3,740	5,610	10,800	17,200	30,400	62,100
1,200	442	923	1,740	3,570	5,350	10,300	16,400	29,000	59,200
1,300	423	884	1,670	3,420	5,120	9,870	15,700	27,800	56,700
1,400	406	849	1,600	3,280	4,920	9,480	15,100	26,700	54,500
1,500	391	818	1,540	3,160	4,740	9,130	14,600	25,700	52,500
1,600	378	790	1,490	3,060	4,580	8,820	14,100	24,800	50,700
1,700	366	765	1,440	2,960	4,430	8,530	13,600	24,000	49,000
1,800	355	741	1,400	2,870	4,300	8,270	13,200	23,300	47,600
1,900	344	720	1,360	2,780	4,170	8,040	12,800	22,600	46,200
2,000	335	700	1,320	2,710	4,060	7,820	12,500	22,000	44,900

Note: All table entries are rounded to 3 significant digits.

Table 6.3.1(c) Schedule 40 Metallic Pipe

Gas:	Undiluted Propane
Inlet Pressure:	2.0 psi
Pressure Drop:	1.0 psi
Specific Gravity:	1.50

INTENDED USE: Pipe Sizing Between 2 psig Service and Line Pressure Regulator.

	Pipe Size (in.)

Nominal:	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 (ft)	Capacity in Thousands of Btu per Hour								
10	2,680	5,590	10,500	21,600	32,400	62,400	99,500	176,000	359,000
20	1,840	3,850	7,240	14,900	22,300	42,900	68,400	121,000	247,000
30	1,480	3,090	5,820	11,900	17,900	34,500	54,900	97,100	198,000
40	1,260	2,640	4,980	10,200	15,300	29,500	47,000	83,100	170,000
50	1,120	2,340	4,410	9,060	13,600	26,100	41,700	73,700	150,000
60	1,010	2,120	4,000	8,210	12,300	23,700	37,700	66,700	136,000
70	934	1,950	3,680	7,550	11,300	21,800	34,700	61,400	125,000
80	869	1,820	3,420	7,020	10,500	20,300	32,300	57,100	116,000
90	815	1,700	3,210	6,590	9,880	19,000	30,300	53,600	109,000
100	770	1,610	3,030	6,230	9,330	18,000	28,600	50,600	103,000
125	682	1,430	2,690	5,520	8,270	15,900	25,400	44,900	91,500
150	618	1,290	2,440	5,000	7,490	14,400	23,000	40,700	82,900
175	569	1,190	2,240	4,600	6,890	13,300	21,200	37,400	76,300
200	529	1,110	2,080	4,280	6,410	12,300	19,700	34,800	71,000
250	469	981	1,850	3,790	5,680	10,900	17,400	30,800	62,900
300	425	889	1,670	3,440	5,150	9,920	15,800	27,900	57,000
350	391	817	1,540	3,160	4,740	9,120	14,500	25,700	52,400
400	364	760	1,430	2,940	4,410	8,490	13,500	23,900	48,800
450	341	714	1,340	2,760	4,130	7,960	12,700	22,400	45,800
500	322	674	1,270	2,610	3,910	7,520	12,000	21,200	43,200
550	306	640	1,210	2,480	3,710	7,140	11,400	20,100	41,100
600	292	611	1,150	2,360	3,540	6,820	10,900	19,200	39,200
650	280	585	1,100	2,260	3,390	6,530	10,400	18,400	37,500
700	269	562	1,060	2,170	3,260	6,270	9,990	17,700	36,000
750	259	541	1,020	2,090	3,140	6,040	9,630	17,000	34,700
800	250	523	985	2,020	3,030	5,830	9,300	16,400	33,500
850	242	506	953	1,960	2,930	5,640	9,000	15,900	32,400
900	235	490	924	1,900	2,840	5,470	8,720	15,400	31,500
950	228	476	897	1,840	2,760	5,310	8,470	15,000	30,500
1,000	222	463	873	1,790	2,680	5,170	8,240	14,600	29,700
1,100	210	440	829	1,700	2,550	4,910	7,830	13,800	28,200
1,200	201	420	791	1,620	2,430	4,680	7,470	13,200	26,900
1,300	192	402	757	1,550	2,330	4,490	7,150	12,600	25,800
1,400	185	386	727	1,490	2,240	4,310	6,870	12,100	24,800
1,500	178	372	701	1,440	2,160	4,150	6,620	11,700	23,900
1,600	172	359	677	1,390	2,080	4,010	6,390	11,300	23,000
1,700	166	348	655	1,340	2,010	3,880	6,180	10,900	22,300
1,800	161	337	635	1,300	1,950	3,760	6,000	10,600	21,600
1,900	157	327	617	1,270	1,900	3,650	5,820	10,300	21,000
2,000	152	318	600	1,230	1,840	3,550	5,660	10,000	20,400

Note: All table entries are rounded to 3 significant digits.

Table 6.3.1(d) Schedule 40 Metallic Pipe

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 (in.)								
Nominal Inside:	½	¾	1	1¼	1½	2	2½	3	4
Actual:	0.622	0.824	1.049	1.380	1.610	2.067	2.469	3.068	4.026
Length (ft)	Capacity in Thousands of Btu per Hour								
10	291	608	1,150	2,350	3,520	6,790	10,800	19,100	39,000
20	200	418	787	1,620	2,420	4,660	7,430	13,100	26,800
30	160	336	632	1,300	1,940	3,750	5,970	10,600	21,500
40	137	287	541	1,110	1,660	3,210	5,110	9,030	18,400
50	122	255	480	985	1,480	2,840	4,530	8,000	16,300
60	110	231	434	892	1,340	2,570	4,100	7,250	14,800
70	101	212	400	821	1,230	2,370	3,770	6,670	13,600
80	94	197	372	763	1,140	2,200	3,510	6,210	12,700
90	89	185	349	716	1,070	2,070	3,290	5,820	11,900
100	84	175	330	677	1,010	1,950	3,110	5,500	11,200
125	74	155	292	600	899	1,730	2,760	4,880	9,950
150	67	140	265	543	814	1,570	2,500	4,420	9,010
175	62	129	243	500	749	1,440	2,300	4,060	8,290
200	58	120	227	465	697	1,340	2,140	3,780	7,710
250	51	107	201	412	618	1,190	1,900	3,350	6,840
300	46	97	182	373	560	1,080	1,720	3,040	6,190
350	42	89	167	344	515	991	1,580	2,790	5,700
400	40	83	156	320	479	922	1,470	2,600	5,300
450	37	78	146	300	449	865	1,380	2,440	4,970
500	35	73	138	283	424	817	1,300	2,300	4,700
550	33	70	131	269	403	776	1,240	2,190	4,460
600	32	66	125	257	385	741	1,180	2,090	4,260
650	30	64	120	246	368	709	1,130	2,000	4,080
700	29	61	115	236	354	681	1,090	1,920	3,920
750	28	59	111	227	341	656	1,050	1,850	3,770
800	27	57	107	220	329	634	1,010	1,790	3,640
850	26	55	104	213	319	613	978	1,730	3,530
900	25	53	100	206	309	595	948	1,680	3,420
950	25	52	97	200	300	578	921	1,630	3,320
1,000	24	50	95	195	292	562	895	1,580	3,230
1,100	23	48	90	185	277	534	850	1,500	3,070

1,200	22	46	86	176	264	509	811	1,430	2,930
1,300	21	44	82	169	253	487	777	1,370	2,800
1,400	20	42	79	162	243	468	746	1,320	2,690
1,500	19	40	76	156	234	451	719	1,270	2,590
1,600	19	39	74	151	226	436	694	1,230	2,500
1,700	18	38	71	146	219	422	672	1,190	2,420
1,800	18	37	69	142	212	409	652	1,150	2,350
1,900	17	36	67	138	206	397	633	1120	2280
2,000	17	35	65	134	200	386	615	1090	2220

Note: All table entries are rounded to 3 significant digits.

Table 6.3.1(e) Semirigid Copper Tubing

Gas:	Undiluted Propane
Inlet Pressure:	10.0 psi
Pressure Drop:	1.0 psi
Specific Gravity:	1.50

INTENDED USE: Tube Sizing Between First-Stage (High-Pressure) Regulator and Second-Stage (Low-Pressure) Regulator.

		Tube Size (in.)								
Nominal:	K & L:	¼	⅜	½	⅝	¾	1	1¼	1½	2
	ACR:	⅜	½	⅝	¾	⅞	1⅛	1⅜	—	—
Outside:		0.375	0.500	0.625	0.750	0.875	1.125	1.375	1.625	2.125
Inside:*		0.305	0.402	0.527	0.652	0.745	0.995	1.245	1.481	1.959
Length (ft)		Capacity in Thousands of Btu per Hour								
10		513	1,060	2,150	3,760	5,330	11,400	20,500	32,300	67,400
20		352	727	1,480	2,580	3,670	7,830	14,100	22,200	46,300
30		283	584	1,190	2,080	2,940	6,290	11,300	17,900	37,200
40		242	500	1,020	1,780	2,520	5,380	9,690	15,300	31,800
50		215	443	901	1,570	2,230	4,770	8,590	13,500	28,200
60		194	401	816	1,430	2,020	4,320	7,780	12,300	25,600
70		179	369	751	1,310	1,860	3,980	7,160	11,300	23,500
80		166	343	699	1,220	1,730	3,700	6,660	10,500	21,900
90		156	322	655	1,150	1,630	3,470	6,250	9,850	20,500
100		147	304	619	1,080	1,540	3,280	5,900	9,310	19,400
125		131	270	549	959	1,360	2,910	5,230	8,250	17,200
150		118	244	497	869	1,230	2,630	4,740	7,470	15,600
175		109	225	457	799	1,130	2,420	4,360	6,880	14,300
200		101	209	426	744	1,060	2,250	4,060	6,400	13,300
250		90	185	377	659	935	2,000	3,600	5,670	11,800
300		81	168	342	597	847	1,810	3,260	5,140	10,700

350	75	155	314	549	779	1,660	3,000	4,730	9,840
400	70	144	292	511	725	1,550	2,790	4,400	9,160
450	65	135	274	480	680	1,450	2,620	4,130	8,590
500	62	127	259	453	643	1,370	2,470	3,900	8,120
550	59	121	246	430	610	1,300	2,350	3,700	7,710
600	56	115	235	410	582	1,240	2,240	3,530	7,350
650	54	111	225	393	558	1,190	2,140	3,380	7,040
700	51	106	216	378	536	1,140	2,060	3,250	6,770
750	50	102	208	364	516	1,100	1,980	3,130	6,520
800	48	99	201	351	498	1,060	1,920	3,020	6,290
850	46	96	195	340	482	1,030	1,850	2,920	6,090
900	45	93	189	330	468	1,000	1,800	2,840	5,910
950	44	90	183	320	454	970	1,750	2,750	5,730
1,000	42	88	178	311	442	944	1,700	2,680	5,580
1,100	40	83	169	296	420	896	1,610	2,540	5,300
1,200	38	79	161	282	400	855	1,540	2,430	5,050
1,300	37	76	155	270	383	819	1,470	2,320	4,840
1,400	35	73	148	260	368	787	1,420	2,230	4,650
1,500	34	70	143	250	355	758	1,360	2,150	4,480
1,600	33	68	138	241	343	732	1,320	2,080	4,330
1,700	32	66	134	234	331	708	1,270	2,010	4,190
1,800	31	64	130	227	321	687	1,240	1,950	4,060
1,900	30	62	126	220	312	667	1,200	1,890	3,940
2,000	29	60	122	214	304	648	1,170	1,840	3,830

Note: All table entries are rounded to 3 significant digits.

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

Table 6.3.1(f) Semirigid Copper Tubing

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 (in.)								
Nominal:	K & L:	¼	⅜	½	⅝	¾	1	1¼	1½	2
	ACR:	⅜	½	⅝	¾	⅞	1⅛	1⅜	—	—
Outside:		0.375	0.500	0.625	0.750	0.875	1.125	1.375	1.625	2.125
Inside:*		0.305	0.402	0.527	0.652	0.745	0.995	1.245	1.481	1.959
Length (ft)		Capacity in Thousands of Btu per Hour								

10	45	93	188	329	467	997	1,800	2,830	5,890
20	31	64	129	226	321	685	1,230	1,950	4,050
30	25	51	104	182	258	550	991	1,560	3,250
40	21	44	89	155	220	471	848	1,340	2,780
50	19	39	79	138	195	417	752	1,180	2,470
60	17	35	71	125	177	378	681	1,070	2,240
70	16	32	66	115	163	348	626	988	2,060
80	15	30	61	107	152	324	583	919	1,910
90	14	28	57	100	142	304	547	862	1,800
100	13	27	54	95	134	287	517	814	1,700
125	11	24	48	84	119	254	458	722	1,500
150	10	21	44	76	108	230	415	654	1,360
175	NA	20	40	70	99	212	382	602	1,250
200	NA	18	37	65	92	197	355	560	1,170
250	NA	16	33	58	82	175	315	496	1,030
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
1,000	NA	NA	16	27	39	83	149	234	488
1,100	NA	NA	15	26	37	78	141	223	464
1,200	NA	NA	14	25	35	75	135	212	442
1,300	NA	NA	14	24	34	72	129	203	423
1,400	NA	NA	13	23	32	69	124	195	407
1,500	NA	NA	13	22	31	66	119	188	392
1,600	NA	NA	12	21	30	64	115	182	378
1,700	NA	NA	12	20	29	62	112	176	366
1,800	NA	NA	11	20	28	60	108	170	355
1,900	NA	NA	11	19	27	58	105	166	345
2,000	NA	NA	11	19	27	57	102	161	335

NA: A flow of less than 10,000 Btu/hr.

Note: All table entries are rounded to 3 significant digits.

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

Table 6.3.1(g) Semirigid Copper Tubing

Gas:	Undiluted Propane
Inlet Pressure:	2.0 psi
Pressure Drop:	1.0 psi
Specific Gravity:	1.50

INTENDED USE: Tube Sizing Between 2 psig Service and Line Pressure Regulator.

		Tube Size (in.)								
Nominal:	K & L:	¼	⅜	½	⅝	¾	1	1¼	1½	2
	ACR:	⅜	½	⅝	¾	⅞	1⅛	1⅜	—	—
Outside:		0.375	0.500	0.625	0.750	0.875	1.125	1.375	1.625	2.125
Inside:*		0.305	0.402	0.527	0.652	0.745	0.995	1.245	1.481	1.959
Length (ft)		Capacity in Thousands of Btu per Hour								
10		413	852	1,730	3,030	4,300	9,170	16,500	26,000	54,200
20		284	585	1,190	2,080	2,950	6,310	11,400	17,900	37,300
30		228	470	956	1,670	2,370	5,060	9,120	14,400	29,900
40		195	402	818	1,430	2,030	4,330	7,800	12,300	25,600
50		173	356	725	1,270	1,800	3,840	6,920	10,900	22,700
60		157	323	657	1,150	1,630	3,480	6,270	9,880	20,600
70		144	297	605	1,060	1,500	3,200	5,760	9,090	18,900
80		134	276	562	983	1,390	2,980	5,360	8,450	17,600
90		126	259	528	922	1,310	2,790	5,030	7,930	16,500
100		119	245	498	871	1,240	2,640	4,750	7,490	15,600
125		105	217	442	772	1,100	2,340	4,210	6,640	13,800
150		95	197	400	700	992	2,120	3,820	6,020	12,500
175		88	181	368	644	913	1,950	3,510	5,540	11,500
200		82	168	343	599	849	1,810	3,270	5,150	10,700
250		72	149	304	531	753	1,610	2,900	4,560	9,510
300		66	135	275	481	682	1,460	2,620	4,140	8,610
350		60	124	253	442	628	1,340	2,410	3,800	7,920
400		56	116	235	411	584	1,250	2,250	3,540	7,370
450		53	109	221	386	548	1,170	2,110	3,320	6,920
500		50	103	209	365	517	1,110	1,990	3,140	6,530
550		47	97	198	346	491	1,050	1,890	2,980	6,210
600		45	93	189	330	469	1,000	1,800	2,840	5,920
650		43	89	181	316	449	959	1,730	2,720	5,670
700		41	86	174	304	431	921	1,660	2,620	5,450
750		40	82	168	293	415	888	1,600	2,520	5,250
800		39	80	162	283	401	857	1,540	2,430	5,070
850		37	77	157	274	388	829	1,490	2,350	4,900
900		36	75	152	265	376	804	1,450	2,280	4,750

950	35	72	147	258	366	781	1,410	2,220	4,620
1,000	34	71	143	251	356	760	1,370	2,160	4,490
1,100	32	67	136	238	338	721	1,300	2,050	4,270
1,200	31	64	130	227	322	688	1,240	1,950	4,070
1,300	30	61	124	217	309	659	1,190	1,870	3,900
1,400	28	59	120	209	296	633	1,140	1,800	3,740
1,500	27	57	115	201	286	610	1,100	1,730	3,610
1,600	26	55	111	194	276	589	1,060	1,670	3,480
1,700	26	53	108	188	267	570	1,030	1,620	3,370
1,800	25	51	104	182	259	553	1,000	1,570	3,270
1,900	24	50	101	177	251	537	966	1,520	3,170
2,000	23	48	99	172	244	522	940	1,480	3,090

Note: All table entries are rounded to 3 significant digits.

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

Table 6.3.1(h) Corrugated Stainless Steel Tubing (CSST)

Gas:	Undiluted Propane
Inlet Pressure:	11.0 in. w.c.
Pressure Drop:	0.5 in. w.c.
Specific Gravity:	1.50

INTENDED USE: CSST Sizing Between Single- or Second-Stage (Low-Pressure) Regulator and Appliance Shutoff Valve.

	Tube Size (EHD)													
Flow Designation:	13	15	18	19	23	25	30	31	37	39	46	48	60	62
Length (ft)	Capacity in Thousands of Btu per Hour													
5	72	99	181	211	355	426	744	863	1,420	1,638	2,830	3,270	5,780	6,550
10	50	69	129	150	254	303	521	605	971	1,179	1,990	2,320	4,110	4,640
15	39	55	104	121	208	248	422	490	775	972	1,620	1,900	3,370	3,790
20	34	49	91	106	183	216	365	425	661	847	1,400	1,650	2,930	3,290
25	30	42	82	94	164	192	325	379	583	762	1,250	1,480	2,630	2,940
30	28	39	74	87	151	177	297	344	528	698	1,140	1,350	2,400	2,680
40	23	33	64	74	131	153	256	297	449	610	988	1,170	2,090	2,330
50	20	30	58	66	118	137	227	265	397	548	884	1,050	1,870	2,080
60	19	26	53	60	107	126	207	241	359	502	805	961	1,710	1,900
70	17	25	49	57	99	117	191	222	330	466	745	890	1,590	1,760
80	15	23	45	52	94	109	178	208	307	438	696	833	1,490	1,650
90	15	22	44	50	90	102	169	197	286	414	656	787	1,400	1,550
100	14	20	41	47	85	98	159	186	270	393	621	746	1,330	1,480
150	11	15	31	36	66	75	123	143	217	324	506	611	1,090	1,210

200	9	14	28	33	60	69	112	129	183	283	438	531	948	1,050
250	8	12	25	30	53	61	99	117	163	254	390	476	850	934
300	8	11	23	26	50	57	90	107	147	234	357	434	777	854

EHD: Equivalent hydraulic diameter. 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.

Notes:

(1) Table includes losses for four 90 degree bends and two end fittings. Tubing runs with larger numbers of bends and/or fittings 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 and/or bends.

(2) All table entries are rounded to 3 significant digits.

Table 6.3.1(i) Corrugated Stainless Steel Tubing (CSST)

-	-	-	-	-	-	-	-	-	-	-	**Gas:**	**Undiluted Propane**
-	-	-	-	-	-	-	-	-	-	-	**Inlet Pressure:**	**2.0 psi**
-	-	-	-	-	-	-	-	-	-	-	**Pressure Drop:**	**1.0 psi**
-	-	-	-	-	-	-	-	-	-	-	**Specific Gravity:**	**1.50**

INTENDED USE: CSST Sizing Between 2 psig Service and Line Pressure Regulator.

-	**Tube Size (EHD)**													
Flow Designation:	**13**	**15**	**18**	**19**	**23**	**25**	**30**	**31**	**37**	**39**	**46**	**48**	**60**	**62**
Length (ft)	**Capacity in Thousands of Btu per Hour**													
10	426	558	927	1,110	1,740	2,170	4,100	4,720	7,130	7,958	15,200	16,800	29,400	34,20
25	262	347	591	701	1,120	1,380	2,560	2,950	4,560	5,147	9,550	10,700	18,800	21,70
30	238	316	540	640	1,030	1,270	2,330	2,690	4,180	4,719	8,710	9,790	17,200	19,80
40	203	271	469	554	896	1,100	2,010	2,320	3,630	4,116	7,530	8,500	14,900	17,20
50	181	243	420	496	806	986	1,790	2,070	3,260	3,702	6,730	7,610	13,400	15,40
75	147	196	344	406	663	809	1,460	1,690	2,680	3,053	5,480	6,230	11,000	12,60
80	140	189	333	393	643	768	1,410	1,630	2,590	2,961	5,300	6,040	10,600	12,20
100	124	169	298	350	578	703	1,260	1,450	2,330	2,662	4,740	5,410	9,530	10,90
150	101	137	245	287	477	575	1,020	1,180	1,910	2,195	3,860	4,430	7,810	8,89(
200	86	118	213	248	415	501	880	1,020	1,660	1,915	3,340	3,840	6,780	7,71(
250	77	105	191	222	373	448	785	910	1,490	1,722	2,980	3,440	6,080	6,90(
300	69	96	173	203	343	411	716	829	1,360	1,578	2,720	3,150	5,560	6,30(
400	60	82	151	175	298	355	616	716	1,160	1,376	2,350	2,730	4,830	5,46(
500	53	72	135	158	268	319	550	638	1,030	1,237	2,100	2,450	4,330	4,88(

EHD: Equivalent hydraulic diameter. 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.

Notes:

(1) Table does not include effect of pressure drop across the line regulator. Where regulator loss exceeds ½ psi (based on 13 in. w.c. outlet pressure), do not use this table. Consult with regulator manufacturer for pressure drops and capacity factors. Pressure drops across a

regulator may vary with flow rate.

(2) CAUTION: Capacities shown in table may exceed maximum capacity for a selected regulator. Consult with regulator or tubing manufacturer for guidance.

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

(4) All table entries are rounded to 3 significant digits.

Table 6.3.1(j) Corrugated Stainless Steel Tubing (CSST)

-	-	-	-	-	-	-	-	-	-	-	Gas:	Undil Propa
-	-	-	-	-	-	-	-	-	-	-	Inlet Pressure:	5.0 ps
-	-	-	-	-	-	-	-	-	-	-	Pressure Drop:	3.5 ps
-	-	-	-	-	-	-	-	-	-	-	Specific Gravity:	1.50

-	Tube Size (EHD)												
Flow Designation:	13	15	18	19	23	25	30	31	37	39	46	48	60
Length (ft)	Capacity in Thousands of Btu per Hour												
10	826	1,070	1,710	2,060	3,150	4,000	7,830	8,950	13,100	14,441	28,600	31,200	54,400
25	509	664	1,090	1,310	2,040	2,550	4,860	5,600	8,400	9,339	18,000	19,900	34,700
30	461	603	999	1,190	1,870	2,340	4,430	5,100	7,680	8,564	16,400	18,200	31,700
40	396	520	867	1,030	1,630	2,030	3,820	4,400	6,680	7,469	14,200	15,800	27,600
50	352	463	777	926	1,460	1,820	3,410	3,930	5,990	6,717	12,700	14,100	24,700
75	284	376	637	757	1,210	1,490	2,770	3,190	4,920	5,539	10,300	11,600	20,300
80	275	363	618	731	1,170	1,450	2,680	3,090	4,770	5,372	9,990	11,200	19,600
100	243	324	553	656	1,050	1,300	2,390	2,760	4,280	4,830	8,930	10,000	17,600
150	196	262	453	535	866	1,060	1,940	2,240	3,510	3,983	7,270	8,210	14,400
200	169	226	393	464	755	923	1,680	1,930	3,050	3,474	6,290	7,130	12,500
250	150	202	352	415	679	828	1,490	1,730	2,740	3,124	5,620	6,390	11,200
300	136	183	322	379	622	757	1,360	1,570	2,510	2,865	5,120	5,840	10,300
400	117	158	279	328	542	657	1,170	1,360	2,180	2,498	4,430	5,070	8,920
500	104	140	251	294	488	589	1,050	1,210	1,950	2,247	3,960	4,540	8,000

EHD: Equivalent hydraulic diameter. 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.

Notes:

(1) Table does not include effect of pressure drop across the line regulator. Where regulator loss exceeds ½ psi (based on 13 in. w.c. outlet pressure), do not use this table. Consult with regulator manufacturer for pressure drops and capacity factors. Pressure drops across a regulator may vary with flow rate.

(2) CAUTION: Capacities shown in table may exceed maximum capacity for a selected regulator. Consult with regulator or tubing manufacturer for guidance.

(3) Table includes losses for four 90 degree bends and two end fittings. Tubing runs with larger number of bends and/or fittings shall be increased by an equivalent length of tubing according

to the following equation: $L = 1.3n$, where L is additional length (ft) of tubing and n is the number of additional fittings and/or bends.

(4) All table entries are rounded to 3 significant digits.

Table 6.3.1(k) Polyethylene Plastic Pipe

Gas:	Undiluted Propane
Inlet Pressure:	11.0 in. w.c.
Pressure Drop:	0.5 in. w.c.
Specific Gravity:	1.50

INTENDED USE: PE Pipe Sizing Between Integral Second-Stage Regulator at Tank or Second-Stage (Low-Pressure) Regulator and Building.

	Pipe Size (in.)							
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 (ft)	Capacity in Thousands of Btu per Hour							
10	340	680	1,230	2,130	3,210	5,770	16,000	30,900
20	233	468	844	1,460	2,210	3,970	11,000	21,200
30	187	375	677	1,170	1,770	3,180	8,810	17,000
40	160	321	580	1,000	1,520	2,730	7,540	14,600
50	142	285	514	890	1,340	2,420	6,680	12,900
60	129	258	466	807	1,220	2,190	6,050	11,700
70	119	237	428	742	1,120	2,010	5,570	10,800
80	110	221	398	690	1,040	1,870	5,180	10,000
90	103	207	374	648	978	1,760	4,860	9,400
100	98	196	353	612	924	1,660	4,590	8,900
125	87	173	313	542	819	1,470	4,070	7,900
150	78	157	284	491	742	1,330	3,690	7,130
175	72	145	261	452	683	1,230	3,390	6,560
200	67	135	243	420	635	1,140	3,160	6,100
250	60	119	215	373	563	1,010	2,800	5,410
300	54	108	195	338	510	916	2,530	4,900
350	50	99	179	311	469	843	2,330	4,510
400	46	92	167	289	436	784	2,170	4,190
450	43	87	157	271	409	736	2,040	3,930
500	41	82	148	256	387	695	1,920	3,720

Note: All table entries are rounded to 3 significant digits.

Table 6.3.1(l) Polyethylene Plastic Pipe

Gas:	Undiluted Propane
Inlet Pressure:	2.0 psi
Pressure Drop:	1.0 psi

						Specific Gravity:	1.50	

INTENDED USE: PE Pipe Sizing Between 2 psi Service Regulator and Line Pressure Regulator.

	Pipe Size (in.)							
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 (ft)	Capacity in Thousands of Btu per Hour							
10	3,130	6,260	11,300	19,600	29,500	53,100	147,000	284,000
20	2,150	4,300	7,760	13,400	20,300	36,500	101,000	195,000
30	1,730	3,450	6,230	10,800	16,300	29,300	81,100	157,000
40	1,480	2,960	5,330	9,240	14,000	25,100	69,400	134,100
50	1,310	2,620	4,730	8,190	12,400	22,200	61,500	119,000
60	1,190	2,370	4,280	7,420	11,200	20,100	55,700	108,000
70	1,090	2,180	3,940	6,830	10,300	18,500	51,300	99,100
80	1,010	2,030	3,670	6,350	9,590	17,200	47,700	92,200
90	952	1,910	3,440	5,960	9,000	16,200	44,700	86,500
100	899	1,800	3,250	5,630	8,500	15,300	42,300	81,700
125	797	1,600	2,880	4,990	7,530	13,500	37,500	72,400
150	722	1,450	2,610	4,520	6,830	12,300	33,900	65,600
175	664	1,330	2,400	4,160	6,280	11,300	31,200	60,300
200	618	1,240	2,230	3,870	5,840	10,500	29,000	56,100
250	548	1,100	1,980	3,430	5,180	9,300	25,700	49,800
300	496	994	1,790	3,110	4,690	8,430	23,300	45,100
350	457	914	1,650	2,860	4,320	7,760	21,500	41,500
400	425	851	1,530	2,660	4,020	7,220	12,000	38,600
450	399	798	1,440	2,500	3,770	6,770	18,700	36,200
500	377	754	1,360	2,360	3,560	6,390	17,700	34,200
550	358	716	1,290	2,240	3,380	6,070	16,800	32,500
600	341	683	1,230	2,140	3,220	5,790	16,000	31,000
650	327	654	1,180	2,040	3,090	5,550	15,400	29,700
700	314	628	1,130	1,960	2,970	5,330	14,700	28,500
750	302	605	1,090	1,890	2,860	5,140	14,200	27,500
800	292	585	1,050	1,830	2,760	4,960	13,700	26,500
850	283	566	1,020	1,770	2,670	4,800	13,300	25,700
900	274	549	990	1,710	2,590	4,650	12,900	24,900
950	266	533	961	1,670	2,520	4,520	12,500	24,200
1,000	259	518	935	1,620	2,450	4,400	12,200	23,500
1,100	246	492	888	1,540	2,320	4,170	11,500	22,300
1,200	234	470	847	1,470	2,220	3,980	11,000	21,300
1,300	225	450	811	1,410	2,120	3,810	10,600	20,400
1,400	216	432	779	1,350	2,040	3,660	10,100	19,600
1,500	208	416	751	1,300	1,960	3,530	9,760	18,900

1,600	201	402	725	1,260	1,900	3,410	9,430	18,200
1,700	194	389	702	1,220	1,840	3,300	9,130	17,600
1,800	188	377	680	1,180	1,780	3,200	8,850	17,100
1,900	183	366	661	1,140	1,730	3,110	8,590	16,600
2,000	178	356	643	1,110	1,680	3,020	8,360	16,200

Note: All table entries are rounded to 3 significant digits.

Table 6.3.1(m) Polyethylene Plastic Tubing

-	Gas:	Undiluted Propane
-	Inlet Pressure:	11.0 in. w.c.
-	Pressure Drop:	0.5 in. w.c.
-	Specific Gravity:	1.50

INTENDED USE: Sizing Between Integral 2-Stage Regulator at Tank or Second-Stage (Low-Pressure Regulator) and the Building.		
Plastic Tubing Size (CTS) (in.)		
Nominal OD:	½	1
Designation:	SDR 7	SDR 11
Actual ID:	0.445	0.927
Length (ft)	Capacity in Thousands of Btu per Hour	
10	121	828
20	83	569
30	67	457
40	57	391
50	51	347
60	46	314
70	42	289
80	39	269
90	37	252
100	35	238
125	31	211
150	28	191
175	26	176
200	24	164
225	22	154
250	21	145
275	20	138
300	19	132
350	18	121
400	16	113
450	15	106
500	15	100

CTS: Copper tube size.

Note: All table entries are rounded to 3 significant digits.

6.3.2

Section 6.4 shall be used in conjunction with one of the methods described in 6.1.2 through 6.1.4 for non-corrugated stainless steel tubing.

6.4 Sizing Equations.

The inside diameter of smooth wall pipe or tubing shall be determined by the sizing equations in 6.4.1 and 6.4.2 using the equivalent pipe length determined by the methods in 6.1.2 through 6.1.4.

6.4.1* Low-Pressure Gas Formula.

Less than 1.5 psi (10.3 kPa):

$$D = \frac{Q^{0.381}}{19.17\left(\frac{\Delta H}{Cr \times L}\right)^{0.206}} \quad \textbf{[6.4.1]}$$

where:

D = inside diameter of pipe (in.)

Q = input rate appliance(s) (cubic feet per hour at 60°F and 30 in. mercury column)

ΔH = pressure drop [in. w.c. (27.7 in. H_2O = 1 psi)]

L = equivalent length of pipe (ft)

See Table 6.4.2 for values of *Cr*.

6.4.2* High-Pressure Gas Formula.

1.5 psi (10.3 kPa) and above:

$$D = \frac{Q^{0.381}}{18.93\left[\frac{\left(P_1^2 - P_2^2\right) \cdot Y}{Cr \times L}\right]^{0.206}} \quad \textbf{[6.4.2]}$$

where:

D = inside diameter of pipe (in.)

Q = input rate appliance(s) (cubic feet per hour at 60°F and 30 in. mercury column)

P_1 = upstream pressure [psia (P_1 + 14.7)]

P_2 = downstream pressure [psia (P_2 + 14.7)]

L = equivalent length of pipe (ft)

See Table 6.4.2 for values of *Cr* and *Y*.

Table 6.4.2 ***Cr*** and ***Y*** for Natural Gas and Undiluted Propane at Standard Conditions

-	Formula Factors	
Gas	*Cr*	*Y*
Natural gas	0.6094	0.9992
Undiluted propane	1.2462	0.9910

Additional Proposed Changes

File Name	Description	Approved
Public_Comment_No._43-NFPA_54-2022.docx	PC 43 in WORD Format	

Statement of Problem and Substantiation for Public Comment

Sizing tables for PEX-AL-PEX piping have traditionally been found in the manufacturer's instructions. This PC adds the sizing tables to the standard.

Related Item

• Public Input No. 91-NFPA 54-2021

Submitter Information Verification

Submitter Full Name: Andrew Klein
Organization: A S Klein Engineering PLLC
Affiliation: Ferguson Enterprises
Street Address:
City:
State:
Zip:
Submittal Date: Mon May 30 23:47:10 EDT 2022
Committee: NFG-AAA

Committee Statement

Committee Action: Rejected

Resolution: Public Comments 41, 44, 45 The proposed composite tubing product (PEX-AL-PEX) as presented does not have a fire resistance that matches other similar metallic piping products that are currently recognized in Section 5.5 of the NFPA 54. The proposed PEX-AL-PEX fitting do not meet ANSI LC 4 for press-to-connect fittings (which requires 1000F). Brazing also requires a high temperature fitting (1000F). The ISO 17484-1 Standard proposed for the material does not include fire resistance requirements, and the proposed requirements do not require additional fire protection methods such as excess flow valves or external fire protection (installation behind gypsum walls). The requirement language did not require the listing to the ISO 17484-1 rather compliance to the standard. Public Comments 40, 42, 43 The definition and sizing tables were not added as the proposed piping material was not added to the code.

Public Comment No. 8-NFPA 54-2022 [Section No. 6.1.4]

6.1.4 Hybrid Pressure.

~~The pipe size for each section of higher pressure gas piping shall be determined~~
6.1.3 Hybrid Pressure. Sizing of high and low pressure portions of a hybrid pressure system shall be determined:

a. For the high pressure portion using the longest length of piping method in 6.1.1 or the branch length method in 6.1.2 from the point of delivery to the most remote line pressure regulator.

~~The pipe size from the line pressure regulator to each outlet shall be determined using the length of piping from the regulator to the most remote outlet served by the regulator~~

b. For each section of lower pressure piping using the longest length of piping method in 6.1.1 or the branch length method in 6.1.2 from the line pressure regulator to the outlets consistent with the sizing method used .

Statement of Problem and Substantiation for Public Comment

Revised to recognize that the longest length and branch length sizing methods should be used to size the high and low pressure portions of a hybrid system, and make the requirement easier to understand.

Related Item

• PI-5

Submitter Information Verification

Submitter Full Name: Theodore Lemoff
Organization: TLemoff Engineering
Affiliation: Omega Flex
Street Address:
City:
State:
Zip:
Submittal Date: Tue Apr 05 13:26:33 EDT 2022
Committee: NFG-AAA

Committee Statement

Committee Action: Rejected
Resolution: The proposed language does not improve the understanding of the requirement as it currently specifies each section of piping for sizing.

Public Comment No. 9-NFPA 54-2022 [Section No. 7.1.3.2]

7.1.3.2

Underground piping shall comply with one or more of the following unless approved ~~technical justification is provided to demonstrate that protection is unnecessary~~ for installation without corrosion protection :

(1) The piping shall be made of corrosion-resistant material that is suitable for the environment in which it will be installed.

(2) Pipe shall have a factory-applied, electrically insulating coating. Fittings and joints between sections of coated pipe shall be coated in accordance with the coating manufacturer's instructions.

(3) The piping shall have a cathodic protection system installed, and the system shall be maintained in accordance with 7.1.3.3 or 7.1.3.6.

Statement of Problem and Substantiation for Public Comment

An identical PI was submitted and rejected. In its response to PI-57 the committee stated that removing the words "technical justification" could allow materials with little or no technical justification".

I agree the committee's statement, but the committee ignored that the text duplicates the meaning of "approved" which is defined and has lengthy Annex A text which provides guidance to AHJs.

Related Item

• PI 57

Submitter Information Verification

Submitter Full Name: Theodore Lemoff
Organization: TLemoff Engineering
Affiliation: None
Street Address:
City:
State:
Zip:
Submittal Date: Tue Apr 05 13:41:11 EDT 2022
Committee: NFG-AAA

Committee Statement

Committee Action: Rejected
Resolution: Technical justification is necessary in the approval of having no corrosion protection.

Public Comment No. 44-NFPA 54-2022 [New Section after 7.2.7]

7.2.8 Composite Piping.

Composite piping systems shall be installed in accordance with this code, ISO 17484-1, and the manufacturers installation instructions.

Statement of Problem and Substantiation for Public Comment

Like CSST, this language emphasizes the need to follow the code and the installation instructions to ensure proper installation for the specific application.

Related Item

• Public Input No. 91-NFPA 54-2021

Submitter Information Verification

Submitter Full Name: Andrew Klein
Organization: A S Klein Engineering PLLC
Affiliation: Ferguson Enterprises
Street Address:
City:
State:
Zip:
Submittal Date: Tue May 31 00:18:27 EDT 2022
Committee: NFG-AAA

Committee Statement

Committee Action: Rejected

Resolution: Public Comments 41, 44, 45 The proposed composite tubing product (PEX-AL-PEX) as presented does not have a fire resistance that matches other similar metallic piping products that are currently recognized in Section 5.5 of the NFPA 54. The proposed PEX-AL-PEX fitting do not meet ANSI LC 4 for press-to-connect fittings (which requires 1000F). Brazing also requires a high temperature fitting (1000F). The ISO 17484-1 Standard proposed for the material does not include fire resistance requirements, and the proposed requirements do not require additional fire protection methods such as excess flow valves or external fire protection (installation behind gypsum walls). The requirement language did not require the listing to the ISO 17484-1 rather compliance to the standard. Public Comments 40, 42, 43 The definition and sizing tables were not added as the proposed piping material was not added to the code.

Public Comment No. 45-NFPA 54-2022 [Section No. 7.3.2]

7.3.2 Fittings in Concealed Locations.

Fittings installed in concealed locations shall be limited to the following types:

(1) Threaded elbows, tees, couplings, caps, and plugs

(2) Brazed fittings

(3) Welded fittings

(4) Fittings listed to ANSI LC 1/CSA 6.26, *Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing (CSST)*, or ANSI LC 4/CSA 6.32, *Press-Connect Metallic Fittings for Use in Fuel Gas Distribution Systems*

(5) Crimp fittings listed to ISO 17484, *Multilayer pipe systems for indoor gas installations with a maximum operating pressure up to and including 5 bar (500 kPa) - Part 1: Specifications for systems* .

Statement of Problem and Substantiation for Public Comment

ISO 17484 contains testing requirements for both the pipe and fitting system together as the fittings are typically designed to be used with the individual piping system only, and fittings cannot be listed to ISO 17484 individually. Crimp fittings are a permanent fitting that has been used successfully in concealed spaces for over 15 years.

Related Item

• Public Input No. 92-NFPA 54-2021

Submitter Information Verification

Submitter Full Name: Andrew Klein
Organization: A S Klein Engineering PLLC
Affiliation: Ferguson Enterprises
Street Address:
City:
State:
Zip:
Submittal Date: Tue May 31 00:22:28 EDT 2022
Committee: NFG-AAA

Committee Statement

Committee Action: Rejected

Resolution: Public Comments 41, 44, 45 The proposed composite tubing product (PEX-AL-PEX) as presented does not have a fire resistance that matches other similar metallic piping products that are currently recognized in Section 5.5 of the NFPA 54. The proposed PEX-AL-PEX fitting do not meet ANSI LC 4 for press-to-connect fittings (which requires 1000F). Brazing also requires a high temperature fitting (1000F). The ISO 17484-1 Standard proposed for the material does not include fire resistance requirements, and

the proposed requirements do not require additional fire protection methods such as excess flow valves or external fire protection (installation behind gypsum walls). The requirement language did not require the listing to the ISO 17484-1 rather compliance to the standard. Public Comments 40, 42, 43 The definition and sizing tables were not added as the proposed piping material was not added to the code.

Public Comment No. 10-NFPA 54-2022 [Section No. 8.2.3]

8.2.3* Leak Check.

8.2.3.1 Immediately after the gas is turned on into a new system or into a system that has been initially restored after an interruption of service, the piping system shall be checked for leakage.

8.2.3.2 Where leakage is indicated, the gas supply shall be shut off until the necessary repairs have been made.

8.2.3.3 Where minor repairs have been made in accordance with 8.1.1.3, no additional leak checks shall be required.

Statement of Problem and Substantiation for Public Comment

The committee rejected this recommendation in PI-64 stating: “Any repairs require a leak check prior to placing the system back into use.” The proposed reference to 8.1.1.3, which includes requirements for leak testing provides this check. The committee’s technical substantiation did not support the rejection of PI-64 and this comment should be accepted.

Related Item

• PI 64

Submitter Information Verification

Submitter Full Name: Theodore Lemoff
Organization: TLemoff Engineering
Affiliation: None
Street Address:
City:
State:
Zip:
Submittal Date: Tue Apr 05 13:46:24 EDT 2022
Committee: NFG-AAA

Committee Statement

Committee Action: Rejected
Resolution: With the definition of interruption of service at the first draft stage there is no further need for this revision.

Public Comment No. 47-NFPA 54-2022 [Section No. 8.3.4]

8.3.4 Abandoned Fuel Gas Piping.

Where fuel gas piping is removed from service for an indefinite time period, it shall be purged of fuel gas .

Statement of Problem and Substantiation for Public Comment

This is an editorial change that may seem obvious to most but will remove any ambiguity.

Related Item

• FR No. 43

Submitter Information Verification

Submitter Full Name: Bruce Swiecicki
Organization: National Propane Gas Associati
Affiliation: NPGA
Street Address:
City:
State:
Zip:
Submittal Date: Tue May 31 15:20:26 EDT 2022
Committee: NFG-AAA

Committee Statement

Committee Action: Rejected
Resolution: Fuel gas piping is the specified piping to be purged so adding "of fuel gas" is redundant.

Public Comment No. 18-NFPA 54-2022 [Section No. 9.1.6.1]

9.1.6.1

Where ~~corrosive~~ corrosive fumes or ~~flammable process fumes or~~ gases ~~, such as carbon monoxide, hydrogen sulfide, ammonia, chlorine, and halogenated hydrocarbons, as are present, means for their safe disposal shall be provided.~~ are present in the appliance operating environment in concentrations that can compromise the appliances safe operations the following shall be provided:

a) A means for safe disposal or dilution of the corrosive fumes shall be provided.

b) The appliance shall be listed and labeled for the environmental conditions.

c) Fired appliances shall be located in a mechanical room separate or partitioned off from other areas with provisions for combustion and dilution air from outdoors.

d) The appliance shall be direct vent and installed in accordance with the appliance manufacturers installation instructions.

Statement of Problem and Substantiation for Public Comment

The committee rejected PI 50 identifying conflicts in the way it was written. I have removed the flammable gas issue because if the appliance is actually subjected to a flammable gas environment it would likely be a hazardous condition and also not compliant with a listing requirement. Likely that nothing is listed to be operated in a flammable environment. This revision has been reduced in complexity and made more focused on what I believe the original intent of this item was, (corrosive) environements.

Related Item

• PI 50

Submitter Information Verification

Submitter Full Name: John Puskar
Organization: Prescient Technical Services L
Street Address:
City:
State:
Zip:
Submittal Date: Fri Apr 15 18:55:55 EDT 2022
Committee: NFG-AAA

Committee Statement

Committee Action: Rejected
Resolution: The proposed new list of requirements is not an improvement on the current requirement.

Public Comment No. 19-NFPA 54-2022 [Section No. 9.1.6.2]

~~9.1.6.2~~ –

~~Where chemicals that generate corrosive or flammable products such as aerosol sprays are routinely used, one of the following shall apply to fired appliances where these chemicals can enter combustion air:~~

(1) ~~Fired appliances shall be located in a mechanical room separate or partitioned off from other areas with provisions for combustion and dilution air from outdoors.~~

(2) ~~The appliances shall be direct vent and installed in accordance with the appliance manufacturer's installation instructions.~~

Statement of Problem and Substantiation for Public Comment

Propose eliminating this and instead addressing these issues in 9.1.6.1 PC

Related Item

• PI 49

Submitter Information Verification

Submitter Full Name: John Puskar
Organization: Prescient Technical Services L
Street Address:
City:
State:
Zip:
Submittal Date: Fri Apr 15 19:15:29 EDT 2022
Committee: NFG-AAA

Committee Statement

Committee Action: Rejected

Resolution: The proposed new list of requirements is not an improvement on the current requirement.

Public Comment No. 20-NFPA 54-2022 [Section No. 9.1.7]

~~**9.1.7** – Process Air.~~

~~In addition to air needed for combustion in commercial or industrial processes, process air shall be provided as required for cooling of appliances, equipment, or material; for controlling dew point, heating, drying, oxidation, dilution, safety exhaust, odor control, and air for compressors; and for comfort and proper working conditions for personnel.~~

Statement of Problem and Substantiation for Public Comment

This should be annex material. It's not enforceable. It contains things that would be installation requirements by the manufacturer. It contains comfort things that would be ventilation related.

Related Item

• PI 53

Submitter Information Verification

Submitter Full Name: John Puskar
Organization: Prescient Technical Services L
Street Address:
City:
State:
Zip:
Submittal Date: Fri Apr 15 19:30:29 EDT 2022
Committee: NFG-AAA

Committee Statement

Committee Action: Rejected
Resolution: The requirement for process air is necessary for commercial or industrial processes in order to provide for all the items in the current requirement.

Public Comment No. 21-NFPA 54-2022 [Section No. 9.1.8.2]

9.1.8.2

~~At the~~ If locations selected for installation of appliances and equipment ~~, the~~ are other than at grade on a slab or within a basement the following shall be provided:

a) The dynamic and static load~~-~~ carrying capacities of the building structure ~~shall be checked~~ must be validated by a licensed engineer to determine ~~whether they are~~ that they are adequate to carry the additional loads.

b) The appliances and equipment shall be supported and shall be connected to the piping so as not to exert undue stress on the connections.

Statement of Problem and Substantiation for Public Comment

The current language is not enforceable. The determination of static and dynamic loads is a very complex requirement that usually requires sophisticated software models and considerable expertise. This needs to be in the hands of a qualified professional engineer. I also made for no requirement for this if equipment is installed on a slab in a basement or at grade since the load is not then supported by the building structure.

Related Item

• PI 83

Submitter Information Verification

Submitter Full Name: John Puskar
Organization: Prescient Technical Services L
Street Address:
City:
State:
Zip:
Submittal Date: Sat Apr 16 07:28:30 EDT 2022
Committee: NFG-AAA

Committee Statement

Committee Action: Rejected
Resolution: The addition of a licensed engineer is an excessive requirement and there is no technical justification to exempt slabs and basements from the loading requirements.

Public Comment No. 39-NFPA 54-2022 [Section No. 9.1.17]

~~**9.1.17** – Gas Appliance Pressure Regulators.~~

~~Where the gas supply pressure is higher than that at which the appliance is designed to operate or varies beyond the design pressure limits of the appliance, a gas appliance pressure regulator listed in accordance with ANSI Z21.18/CSA 6.3, *Gas Appliance Pressure Regulators* , shall be installed.~~

Statement of Problem and Substantiation for Public Comment

Appliance pressure regulators are part of appliances, and are not covered by this Code, therefore requirements for such regulators are deleted. Alternately, the requirement could be revised to require line pressure regulators.

Related Item

• FR-12

Submitter Information Verification

Submitter Full Name: Theodore Lemoff
Organization: TLemoff Engineering
Affiliation: None
Street Address:
City:
State:
Zip:
Submittal Date: Fri May 20 13:52:17 EDT 2022
Committee: NFG-AAA

Committee Statement

Committee Action: Rejected
Resolution: Gas appliance regulators are under the scope of the code and requirements are needed for them.

Public Comment No. 22-NFPA 54-2022 [Section No. 9.1.21]

9.1.21 Protection of Outdoor Appliances.

Appliances not listed for outdoor installation but installed outdoors shall be provided with protection to the degree that the environment requires. Appliances listed for outdoor installation shall be permitted to be installed without protection in accordance with the manufacturer's installation instructions.

Statement of Problem and Substantiation for Public Comment

In my opinion, this is a horrible section. It tells people that they can knowingly violate listing standards. The statement is made that you can install an indoor appliance outside so long as you accommodate environmental issues. The real issue is that you would have to make the environment equivalent or better to whatever the listing requirements needed them to be. We cannot expect installers to understand all of the nuances of listing requirements or listing standards and then attempt to replicate them completely and reliably in the field. Who would want to take responsibility for these kinds of accommodations and why? The second sentence in the statement is completely worthless since all equipment is already understood to be able to be installed according to the manufacturer's requirements. This item is better removed, too much risk, and not enforceable.

Related Item

• PI 84

Submitter Information Verification

Submitter Full Name: John Puskar
Organization: Prescient Technical Services L
Street Address:
City:
State:
Zip:
Submittal Date: Sat Apr 16 07:41:14 EDT 2022
Committee: NFG-AAA

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-16-NFPA 54-2022
Statement: Appliances need to be listed for outdoor installation as there are a number of considerations (wind, rain, etc.) that are necessary for safe outdoor installation and the listing standards take these into consideration.

Public Comment No. 14-NFPA 54-2022 [Section No. 10.11.2]

10.11.2 Clearance for Listed Appliances.

10.11.2.1 Floor-mounted food service appliances, ~~such as ranges for hotels and restaurants, deep fat fryers, unit broilers, kettles, steam cookers, steam generators, and baking and roasting ovens,~~ shall be installed at least 6 in. (150 mm) from combustible material except that at least a 2 in. (50 mm) clearance shall ~~be maintained~~ be provided between a draft hood and combustible material.

10.11.2.2 Floor-mounted food service appliances listed for installation at lesser clearances shall be installed in accordance with the manufacturer's installation instructions.

10.11.2.3 Appliances designed and marked "For use only in noncombustible locations" shall not be installed elsewhere.

A.10.11.2 Examples of floor-mounted food service appliances are ranges for hotels and restaurants, deep fat fryers, unit broilers, kettles, steam cookers, steam generators, and baking and roasting ovens.

Statement of Problem and Substantiation for Public Comment

1. The requirements is separated into 3 paragraphs, as they are separate requirements
2. The list of floor-mounted food service appliances is relocated to Annex A as lists are never complete, and belong in Annex A.
3. The requirement for clearance between a draft hood and combustible material is revised that the clearance be provided, rather than maintained. It is not the responsibility of the installer to maintain this distance into the future, rather to ensure that is exists at the time of installation.

Related Item

• PI 70

Submitter Information Verification

Submitter Full Name: Theodore Lemoff
Organization: TLemoff Engineering
Affiliation: None
Street Address:
City:
State:
Zip:
Submittal Date: Wed Apr 06 14:42:30 EDT 2022
Committee: NFG-AAA

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-17-NFPA 54-2022

Statement: 1. The requirements is separated into 3 paragraphs, as they are separate requirements

2. The list of floor-mounted food service appliances is relocated to Annex A as lists are never complete, and belong in Annex A.

3. The requirement for clearance between a draft hood and combustible material is revised that the clearance be provided, rather than maintained. It is not the responsibility of the installer to maintain this distance into the future, rather to ensure that is exists at the time of installation.

Public Comment No. 11-NFPA 54-2022 [Section No. 10.17.2]

10.17.2 Protection ~~Above Domestic Units.~~

~~Domestic~~

Above Open Top Broilers.

10.17.2.1 open-top broiler ~~units~~ units shall be provided with a metal ventilating hood not less than 0.0122 in. (0.3 mm) thick with a clearance of not less than ¼ in. (6 mm) between the hood and the underside of combustible material or metal cabinets. ~~A clearance of at least 24 in. (610 mm) shall be maintained between the~~

10.17.2.2 The clearance between the cooking top and the combustible material or metal cabinet, and the hood shall be ~~at~~ a minimum of 24 in. (610 mm) at least as wide as the open-top broiler unit and centered over the unit. ~~Domestic~~

10.17.2.3 open-top broiler units installed in residential occupancies incorporating an integral exhaust system and listed for use without a ventilating hood shall not be required to be provided with a ventilating hood if installed in accordance with 10.13.3.1(1).

Statement of Problem and Substantiation for Public Comment

1. The requirement is separated into 3 separate paragraphs as there are 3 different requirements
2. The term "domestic" is deleted as it does not appear to be used in the Z21 appliance standards, and the requirement is revised to be applicable to all open top broiler units.

Related Item

• PI 68

Submitter Information Verification

Submitter Full Name: Theodore Lemoff
Organization: TLemoff Engineering
Affiliation: None
Street Address:
City:
State:
Zip:
Submittal Date: Tue Apr 05 14:08:28 EDT 2022
Committee: NFG-AAA

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-18-NFPA 54-2022
Statement: The requirement is separated into 4 separate paragraphs as there are 4 different requirements

Public Comment No. 2-NFPA 54-2022 [New Section after 10.18]

10.18.1 Ventilation.

When an outdoor cooking appliance is mounted above a cabinet or other space capable of allowing the accumulation of the fuel gas, ventilation shall be required. A minimum of two (2) vents shall be placed on opposite sides of the cabinet or space and within three (3) inches of the bottom of the space. Each vent shall be at a minimum 4 x 4 inches (or 4.5 inches diameter) or equivalent with a minimum of 16 square inches of unrestricted opening.

Statement of Problem and Substantiation for Public Comment

As a fire investigator, I have investigated far to many built-in gas grill explosions. Manufacturers' instructions are often lacking as to how to provide ventilation when, 1) gas is piped in versus the use of an attached propane cylinder, 2) provide proper ventilation when there is an attached propane cylinder, 3) how to provide any ventilation at all. I have even run across manufacturers' instructions which, when it comes to ventilation for their product, have only said "follow NFPA rules for ventilation"! Clearly, some minimum guidance is needed. While providing a minimum ventilation requirement will not prevent all fire/explosion incidents, it can prevent a good number of them.

Related Item

- Public Safety

Submitter Information Verification

Submitter Full Name: Richard Meier
Organization: Meier Fire Investigation LLC
Street Address:
City:
State:
Zip:
Submittal Date: Sat Mar 19 07:25:32 EDT 2022
Committee: NFG-AAA

Committee Statement

Committee Action: Rejected but held
Resolution: This subject is new material for this cycle and will be considered for the next cycle.

Public Comment No. 33-NFPA 54-2022 [Section No. 11.6]

11.6* Checking the Draft.

Draft hood–equipped appliances shall be checked to verify that there is no draft hood spillage after 5 minutes of main burner operation under the following conditions:

(1) The building or structure envelope is complete and intact ~~, and all openings to the outdoors are closed~~ such that it represents the future operating conditions of the appliances .

(2) All combustion air systems and openings are in place.

(3) All air-exhausting appliances, power-vented appliances, and exhaust fans are operating.

(4) All air-moving equipment used for heating, cooling, or ventilation is operating.

(5) The draft hood spillage test is conducted only after all previous conditions in this section are established.

Statement of Problem and Substantiation for Public Comment

This is submitted by the TG on combustion air. The revisions provide a more complete set of circumstances that could impact the accuracy and usefulness of a draft test. The new considerations include the impacts of exhaust fan and air handler operations and the state of the building completion and configuration.

Related Item

• PC 33

Submitter Information Verification

Submitter Full Name: John Puskar
Organization: Prescient Technical Services L
Street Address:
City:
State:
Zip:
Submittal Date: Mon May 16 10:44:27 EDT 2022
Committee: NFG-AAA

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-25-NFPA 54-2022
Statement: The revisions provide a more complete set of circumstances that could impact the accuracy and usefulness of a draft test. The new considerations include the impacts of exhaust fan and air handler operations and the state of the building completion and configuration.

Public Comment No. 12-NFPA 54-2022 [Section No. 12.3.2 [Excluding any Sub-Sections]]

The following appliances shall not be required to be vented:

(1) Listed ranges

(2) Built-~~in domestic~~ in cooking units listed and marked for optional venting

(3) Listed hot plates

(4) Listed Type 1 clothes dryers exhausted in accordance with Section 10.4

(5) A single listed booster-type (automatic instantaneous) water heater, when designed and used solely for the sanitizing rinse requirements of a dishwashing machine, provided that the appliance is installed with the draft hood in place and unaltered, if a draft hood is required, in a commercial kitchen having a mechanical exhaust system [Where installed in this manner, the draft hood outlet shall not be less than 36 in. (910 mm) vertically and 6 in. (150 mm) horizontally from any surface other than the appliance.]

(6) Listed refrigerators

(7) Counter appliances

(8) Room heaters listed for unvented use

(9) Direct gas–fired make-up air heaters

(10) Other appliances listed for unvented use and not provided with flue collars

(11) Specialized appliances of limited input such as laboratory burners or gas lights

Statement of Problem and Substantiation for Public Comment

The requirement in (2) is revised by deleting "domestic" and will apply to all built in cooking units. Domestic is deleted because:
1. Domestic is not defined.
2. Domestic was used in the ANSI Z21 standards, but this is being replaced by "household".
3. The requirement is the same with or without "domestic"

Related Item

• PI 72

Submitter Information Verification

Submitter Full Name: Theodore Lemoff
Organization: TLemoff Engineering
Affiliation: None
Street Address:
City:
State:
Zip:
Submittal Date: Tue Apr 05 14:24:47 EDT 2022
Committee: NFG-AAA

Committee Statement

Committee Action:	Rejected but see related SR
Resolution:	SR-27-NFPA 54-2022
Statement:	Domestic is deleted because: 1. Domestic is not defined. 2. Domestic was used in the ANSI Z21 standards, but this is being replaced by "household". 3. The requirement is the same with or without "domestic" See Global SR32 for related multi-requirement changes.

Public Comment No. 13-NFPA 54-2022 [Section No. A.5.3.2.1]

A.5.3.2.1

Some older appliances do not have a nameplate. In this case Table A.5.3.2.1 or an estimate of the appliance input should be used. The input can be based on the following:

(1) A rating provided by the manufacturer

(2) The rating of similar appliances

(3) Recommendations of the gas supplier

(4) Recommendations of a qualified agency

(5) A gas flow test

(6) Measurement of the orifice size of the appliance

The requirement of 5.3.1 that the piping system provide sufficient gas to each appliance inlet must be complied with.

Table A.5.3.2.1 Approximate Gas Input for ~~Typical~~ Selected Appliances used in residential occupancies

Appliance	Input Btu/hr (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 gal to 40 gal tank	35,000
Water heater, automatic storage 50 gal tank	50,000
Water heater, automatic instantaneous	-
Capacity at 2 gal/min	142,800
Capacity at 4 gal/min	285,000
Capacity at 6 gal/min	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	3,000
Clothes dryer, Type 1 (domestic)	35,000
Gas fireplace direct vent	40,000
Gas log	80,000
Barbecue	40,000
Gas light	2,500

Statement of Problem and Substantiation for Public Comment

The title of the Table A.5.3.2.1 is revised to reflect the contents of the Table. In addition, "domestic" is deleted in 4 table entries.

The term "domestic" is not needed in the table.

Related Item

• PI 73

Submitter Information Verification

Submitter Full Name: Theodore Lemoff
Organization: TLemoff Engineering
Affiliation: None
Street Address:
City:
State:
Zip:
Submittal Date: Tue Apr 05 14:36:44 EDT 2022
Committee: NFG-AAA

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-19-NFPA 54-2022
Statement: The title of the Table A.5.3.2.1 is revised to reflect the contents of the Table. The term "domestic" is not needed in the table as it provides no further information.

Public Comment No. 34-NFPA 54-2022 [Section No. A.9.3.2.2]

A.9.3.2.2

See Table A.9.3.2.2(a) and Table A.9.3.2.2(b).

Table A.9.3.2.2(a) Known Air Infiltration Rate Method: Minimum Space Volume for Appliances Other than Fan-Assisted for Specified Infiltration Rates ***(ACH)***

Appliance Input (Btu/hr)	Space Volume (ft^3)		
	0.25 *ACH*	0.30 *ACH*	0.35 *ACH*
5,000	420	350	300
10,000	840	700	600
15,000	1,260	1,050	900
20,000	1,680	1,400	1,200
25,000	2,100	1,750	1,500
30,000	2,520	2,100	1,800
35,000	2,940	2,450	2,100
40,000	3,360	2,800	2,400
45,000	3,780	3,150	2,700
50,000	4,200	3,500	3,000
55,000	4,620	3,850	3,300
60,000	5,040	4,200	3,600
65,000	5,460	4,550	3,900
70,000	5,880	4,900	4,200
75,000	6,300	5,250	4,500
80,000	6,720	5,600	4,800
85,000	7,140	5,950	5,100
90,000	7,560	6,300	5,400
95,000	7,980	6,650	5,700
100,000	8,400	7,000	6,000
105,000	8,820	7,350	6,300
110,000	9,240	7,700	6,600
115,000	9,660	8,050	6,900
120,000	10,080	8,400	7,200
125,000	10,500	8,750	7,500
130,000	10,920	9,100	7,800
135,000	11,340	9,450	8,100
140,000	11,760	9,800	8,400
145,000	12,180	10,150	8,700
150,000	12,600	10,500	9,000
160,000	13,440	11,200	9,600
170,000	14,280	11,900	10,200
180,000	15,120	12,600	10,800
190,000	15,960	13,300	11,400
200,000	16,800	14,000	12,000
210,000	17,640	14,700	12,600
220,000	18,480	15,400	13,200

Appliance Input (Btu/hr)	Space Volume (ft^3)		
	0.25 *ACH*	0.30 *ACH*	0.35 *ACH*
230,000	19,320	16,100	13,800
240,000	20,160	16,800	14,400
250,000	21,000	17,500	15,000
260,000	21,840	18,200	15,600
270,000	22,680	18,900	16,200
280,000	23,520	19,600	16,800
290,000	24,360	20,300	17,400
300,000	25,200	21,000	18,000

For SI units, 1 ft^3 = 0.028 m^3, 1000 Btu/hr = 0.293 kW.

ACH: Air change per hour.

Table A.9.3.2.2(b) Known Air Infiltration Rate Method: Minimum Space Volume for Fan-Assisted Appliance, for Specified Infiltration Rates ***(ACH)***

Appliance Input (Btu/hr)	Required Volume (ft^3)		
	0.25 *ACH*	0.30 *ACH*	0.35 *ACH*
5,000	300	250	214
10,000	600	500	429
15,000	900	750	643
20,000	1,200	1,000	857
25,000	1,500	1,250	1,071
30,000	1,800	1,500	1,286
35,000	2,100	1,750	1,500
40,000	2,400	2,000	1,714
45,000	2,700	2,250	1,929
50,000	3,000	2,500	2,143
55,000	3,300	2,750	2,357
60,000	3,600	3,000	2,571
65,000	3,900	3,250	2,786
70,000	4,200	3,500	3,000
75,000	4,500	3,750	3,214
80,000	4,800	4,000	3,429
85,000	5,100	4,250	3,643
90,000	5,400	4,500	3,857
95,000	5,700	4,750	4,071
100,000	6,000	5,000	4,286
105,000	6,300	5,250	4,500
110,000	6,600	5,500	4,714
115,000	6,900	5,750	4,929
120,000	7,200	6,000	5,143
125,000	7,500	6,250	5,357
130,000	7,800	6,500	5,571

Appliance Input (Btu/hr)	Required Volume (ft^3)		
	0.25 *ACH*	0.30 *ACH*	0.35 *ACH*
135,000	8,100	6,750	5,786
140,000	8,400	7,000	6,000
145,000	8,700	7,250	6,214
150,000	9,000	7,500	6,429
160,000	9,600	8,000	6,857
170,000	10,200	8,500	7,286
180,000	10,800	9,000	7,714
190,000	11,400	9,500	8,143
200,000	12,000	10,000	8,571
210,000	12,600	10,500	9,000
220,000	13,200	11,000	9,429
230,000	13,800	11,500	9,857
240,000	14,400	12,000	10,286
250,000	15,000	12,500	10,714
260,000	15,600	13,000	11,143
270,000	16,200	13,500	11,571
280,000	16,800	14,000	12,000
290,000	17,400	14,500	12,429
300,000	18,000	15,000	12,857

For SI units, 1 ft^3 = 0.028 m^3, 1000 Btu/hr = 0.293 kW.

ACH: Air change per hour.

Additional Proposed Changes

File Name	Description	Approved
A.9.3.2_December_27.docx	text to add to this section	

Statement of Problem and Substantiation for Public Comment

The text added to this section is work of the TG on combustion air. The added text provides a method for converting ACH50, (which is commonly used in building tightness evaluations), to ACHNAT which is the parameter used in this code.

This additional text provides a better understanding of combustion air deficiencies and the determination of combustion air volume requirements based on the tightness of the building.

Related Item

• Pr 34

Submitter Information Verification

Submitter Full Name: John Puskar
Organization: Prescient Technical Services L
Street Address:
City:

State:
Zip:
Submittal Date: Mon May 16 10:57:43 EDT 2022
Committee: NFG-AAA

Committee Statement

Committee Action: Rejected but see related SR

Resolution: SR-26-NFPA 54-2022

Statement: The added text provides a method for converting ACH50, (which is commonly used in building tightness evaluations), to ACHNAT which is the parameter used in this code.

This additional text provides a better understanding of combustion air deficiencies and the determination of combustion air volume requirements based on the tightness of the building.

*9.3.2.2.

Meeting the requirements of the “Known Air Infiltration Rate Method” is not a guarantee that the equipment will pass the section 11.6 draft test with current tighter construction, and remodeling, and weatherization methods. There are also factors related to building airflows and combustion air that cannot be quantified or predicted including leakage of supply and return ducts in unconditioned spaces, multiple appliances operating at the same time, operation of exhaust fans, wind and weather conditions, and isolation of appliance areas from sources of combustion air by the closing of doors. This code is not a design manual and should not be considered as such. The formula used to determine the required indoor air volume is meant to provide you with the best guidance available at this time. Even tracer gas methods, for determining air infiltration rates, which require specialized equipment, can only determine rates of flow for the time and conditions when the test is conducted.

ACH (air changes per hour) in this formula is the number of air changes that occur within the building by natural means;($ACH_{NAT.}$). Several methods to measure this although many factors affect this value including wind velocities, wind direction, barometric pressure, and the number and type of appliances installed and operated within the building.
Tracer gas methods have been developed to determine ACH. These produce the most reliable values for ACH. However, these methods can be expensive and cumbersome and out of reach of most contractors and or installers. Other published methods for estimating ACH’s include ASHRAE estimating methods and those developed by the Air Conditioning Contractors of America Manual J, Residential Load Calculations, which includes tightness categories and estimated ACH for each category. The most prevalent technology in use today for evaluating air leakage characteristics associated with structures is through the use of blower door testing. This tool does provide a somewhat consistent and quantifiable means for arriving at the air leakage at a uniform depressurization of the building compared to the atmosphere, normally 50 pascals, and is called ACH_{50}. This method has been successfully correlated to tracer gas measured natural air infiltration rates. ASHRAE 62.2 provides a method for converting ACH_{50} to an ACH value that reflects the actual number of air changes under normal conditions, called ACH_{NAT}.

Many buildings constructed to current building and energy codes can achieve very low $ACH_{NAT.}$ values, which require a relatively large indoor volume for naturally drafted appliances. Designers, builders, installers, and inspectors should know that these kinds of values may require indoor air volumes that are greater than structures have available. In these cases, draft testing, identified in section 11.6 of this Code, may fail. This could require an alternate means of appliance venting, replacing the appliance, or other remedies for achieving the required combustion air other than using indoor air.

Public Comment No. 35-NFPA 54-2022 [Chapter G]

Annex G Recommended Procedure for Safety Inspection of an Existing Appliance Installation

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

For SI units, 1 Btu/hr = 0.293 W.

G.1 General.

The following procedure is intended as a guide to aid in determining that an appliance is properly installed and is in a safe condition for continued use. Where a gas supplier performs an inspection, their written procedures should be followed.

G.1.1 Application.

This procedure is intended for existing residential installations of a furnace, boiler, room heater, water heater, cooking appliance, fireplace appliance, and clothes dryer. This procedure should be performed prior to any attempt to modify the appliance installation or building envelope.

G.1.2 Weatherization Programs.

Before a building envelope is to be modified as part of a weatherization program, the existing appliance installation should be inspected in accordance with these procedures. After all unsafe conditions are repaired, and immediately after the weatherization is complete, the appliance inspections in G.5.2 are to be repeated.

G.1.3 Inspection Procedure.

The safety of the building occupant and inspector are to be determined as the first step as described in Section G.2. Only after the ambient environment is found to be safe should inspections of gas piping and appliances be undertaken. It is recommended that all inspections described in Sections G.3, G.4, and G.6, where the appliance is in the off mode, be completed and any unsafe conditions repaired or corrected before continuing with inspections of an operating appliance described in Sections G.5 and G.6.

G.1.4 Manufacturer Instructions.

Where available, the manufacturer’s installation and operating instructions for the installed appliance should be used as part of these inspection procedures to determine if the appliance is installed correctly and is operating properly.

G.1.5 Instruments.

The inspection procedures include measuring for fuel gas and carbon monoxide (CO) and will require the use of a combustible gas detector (CGD) and a CO detector. It is recommended that both types of detectors be listed. Prior to any inspection, the detectors should be calibrated or tested in accordance with the manufacturer's instructions. In addition, it is recommended that the detectors have the following minimum specifications:

(1) Gas Detector: The CGD should be capable of indicating the presence of the type of fuel gas for which it is to be used (e.g. natural gas or propane). The combustible gas detector should be capable of the following:

   (a) *PPM:* Numeric display with a parts per million (ppm) scale from 1 ppm to 900 ppm in 1 ppm increments

   (b) *LEL:* Numeric display with a percent lower explosive limit (% LEL) scale from 0 percent to 100 percent in 1 percent increments

   (c) *Audio:* An audio sound feature to locate leaks

(2) CO Detector: The CO detector should be capable of the following functions and have a numeric display scale as follows:

   (a) *PPM:* For measuring ambient room and appliance emissions a display scale in parts per million (ppm) from 0 to 1,000 ppm in 1 ppm increments

   (b) *Alarm:* A sound alarm function where hazardous levels of ambient CO is found (*see Section G.2 for alarm levels*)

   (c) *Air Free:* Capable of converting CO measurements to an air-free level in ppm. Where a CO detector is used without an air-free conversion function, the CO air free can be calculated in accordance with Footnote 3 in Table G.6.

G.2 Occupant and Inspector Safety.

Prior to entering a building, the inspector should have both a combustible gas detector (CGD) and CO detector turned on, calibrated, and operating. Immediately upon entering the building, a sample of the ambient atmosphere should be taken. Based on CGD and CO detector readings, the inspector should take the following actions:

(1) Where the CO detector indicates a carbon monoxide level of 70 ppm or greater, the inspector should immediately notify the occupant of the need for themselves and any building occupant to evacuate; the inspector should immediately evacuate and call 911.

(2) Where the CO detector indicates a reading between 30 ppm and 70 ppm, the inspector should advise the occupant that high CO levels have been found and recommend that all possible sources of CO be turned off immediately and windows and doors be opened. Where it appears that the source of CO is a permanently installed appliance, advise the occupant to shut the appliance off and have the appliance serviced by a qualified servicing agent.

(3) Where the CO detector indicates CO below 30 ppm, the inspection can continue. (See U.S. Consumer Product Safety Commission, *Responding to Residential Carbon Monoxide Incidents, Guidelines For Fire and Other Emergency Response Personnel*)

(4) Where the CGD indicates a combustible gas level of 20 percent LEL or greater, the inspector should immediately notify the occupant of the need for themselves and any building occupant to evacuate; the inspector should immediately evacuate and call 911.

(5) Where the CGD indicates a combustible gas level below 20 percent LEL, the inspection can continue.

If during the inspection process it is determined a condition exists that could result in unsafe appliance operation, shut off the appliance and advise the owner of the unsafe condition. Where a gas leak is found that may result in an unsafe condition, advise the owner of the unsafe condition and call the gas supplier to turn off the gas supply. The inspector should not continue a safety inspection on an operating appliance, venting system, and piping system until repairs have been made.

G.3 Gas Piping and Connection Inspections.

G.3.1 Leak Checks.

Conduct a test for gas leakage using either a noncorrosive leak detection solution or a CGD confirmed with a leak detection solution.

The preferred method for leak checking is by use of gas leak detection solution applied to all joints. This method provides a reliable visual indication of significant leaks.

The use of a CGD in its audio sensing mode can quickly locate suspect leaks but can be overly sensitive indicating insignificant and false leaks. All suspect leaks found through the use of a CGD should be confirmed using a leak detection solution.

Where gas leakage is confirmed, the owner should be notified that repairs must be made. The inspection should include the following components:

(1) All gas piping fittings located within the appliance space

(2) Appliance connector fittings

(3) Appliance gas valve/regulator housing and connections

G.3.2 Appliance Connector.

Verify that the appliance connection type is compliant with Section 9.6. Inspect flexible appliance connections to determine if they are free of cracks, corrosion, and signs of damage. Verify that there are no uncoated copper alloy connectors. Where connectors are determined to be unsafe or where an uncoated copper alloy connector is found, the appliance shutoff valve should be placed in the off position and the owner notified that the connector must be replaced.

G.3.3 Piping Support.

Inspect piping to determine that it is adequately supported, that there is no undue stress on the piping, and if there are any improperly capped pipe openings.

G.3.4 Bonding.

Verify that the electrical bonding of gas piping is compliant with Section 7.12.

G.4 Inspections to Be Performed with the Appliance Not Operating.

The following safety inspection procedures are performed on appliances that are not operating. These inspections are applicable to all appliance installations.

G.4.1 Preparing for Inspection.

Shut off all gas and electrical power to the appliances located in the same room being inspected. For gas supply, use the shutoff valve in the supply line or at the manifold serving each appliance. For electrical power, place the circuit breaker in the off position or remove the fuse that serves each appliance. A lock type device or tag should be installed on each gas shutoff valve and at the electrical panel to indicate that the service has been shut off for inspection purposes.

G.4.2 Vent System Size and Installation.

Verify that the existing venting system size and installation are compliant with Chapters 12 and 13. The size and installation of venting systems for other than natural draft and Category I appliances should be in compliance with the manufacturer's installation instructions. Inspect the venting system to determine that it is free of blockage, restriction, leakage, corrosion, and other deficiencies that could cause an unsafe condition. Inspect masonry chimneys to determine if they are lined. Inspect plastic venting system to determine that it is free of sagging and it is sloped in an upward direction to the outdoor vent termination.

G.4.3 Combustion Air Supply.

Inspect provisions for combustion air as follows:

(1) *Non-Direct Vent Appliances.* Determine that non-direct vent appliance installations are compliant with the combustion air requirements in Section 9.3. Inspect any interior and exterior combustion air openings and any connected combustion air ducts to determine that there is no blockage, restriction, corrosion, or damage. Inspect to determine if horizontal combustion air ducts are sloped upward toward the air supply source.

(2) *Direct Vent Appliances.* Verify that the combustion air supply ducts and pipes are securely fastened to direct vent appliance and determine that there are no separations, blockage, restriction, corrosion, or other damage. Determine that the combustion air source is located in the outdoors or to areas that freely communicate to the outdoors.

(3) *Unvented Appliances.* Verify that the total input of all unvented room heaters and gas-fired refrigerators installed in the same room or rooms that freely communicate with each other does not exceed 20 Btu/hr/ft^3.

G.4.4 Flooded Appliances.

Inspect the appliance for signs that the appliance has been damaged by flooding. Signs of flooding include a visible water submerge line on the appliance housing, excessive surface or component rust, deposited debris on internal components, and mildew-like odor. Inform the owner that flood-damaged appliances should be replaced.

G.4.5 Flammable Vapors.

Inspect the room/space where the appliance is installed to determine if the area is free of the storage of gasoline or any flammable products such as oil-based solvents, varnishes or adhesives. Where the appliance is installed where flammable products will be stored or used, such as a garage, verify that the appliances burner is a minimum of 18 in. above the floor unless the appliance is listed as flammable vapor ignition–resistant.

G.4.6 Clearances to Combustibles.

Inspect the immediate location where the appliance is installed to determine if the area is free of rags, paper, or other combustibles. Verify that the appliance and venting system is compliant with clearances to combustible building components in 9.2.2.

G.4.7 Appliance Components.

Inspect internal components by removing access panels or other components for the following:

(1) Inspect burners and crossovers for blockage and corrosion. The presence of soot, debris, and signs of excessive heating could indicate incomplete combustion due to blockage or improper burner adjustments.

(2) Metallic and non-metallic hoses for signs of cracks, splitting, corrosion, and loose connections

(3) Signs of improper or incomplete repairs

(4) Modifications that override controls and safety systems

(5) Electrical wiring for loose connections; cracked, missing, or worn electrical insulation; and indications of excessive heat or electrical shorting. Appliances requiring an external electrical supply should be inspected for proper electrical connection in accordance with *NFPA 70*.

G.4.8 Placing Appliances Back in Operation.

Return all inspected appliances and systems to their pre-existing state by reinstalling any removed access panels and components. Turn on the gas supply and electricity to each appliance found in safe condition. Proceed to the operating inspections in Section G.5 through Section G.6.

G.5 Inspections to Be Performed with the Appliance Operating.

The following safety inspection procedures are to be performed on appliances that are operating where there are no unsafe conditions or where corrective repairs have been completed.

G.5.1 General Appliance Operation.

(1) *Initial Startup.* Adjust the thermostat or other control device to start the appliance. Verify that the appliance starts up normally and is operating properly.

Determine that the pilot(s), where provided, is burning properly and that the main burner ignition is satisfactory by interrupting and re-establishing the electrical supply to the appliance in any convenient manner. If the appliance is equipped with a continuous pilot(s), test all pilot safety devices to determine whether they are operating properly by extinguishing the pilot(s) when the main burner(s) is off and determining, after 3 minutes, that the main burner gas does not flow upon a call for heat. If the appliance is not provided with a pilot(s), test for proper operation of the ignition system in accordance with the appliance manufacturer's lighting and operating instructions.

(2) *Flame Appearance.* Visually inspect the flame appearance for proper color and appearance. Visually determine that the main burner gas is burning properly (i.e., no floating, lifting, or flashback). Adjust the primary air shutter as required. If the appliance is equipped with high and low flame controlling or flame modulation, check for proper main burner operation at low flame.

(3) *Appliance Shutdown.* Adjust the thermostat or other control device to shut down the appliance. Verify that the appliance shuts off properly.

G.5.2 Test for Combustion Air and Vent Drafting for Natural Draft and Category I Appliances.

Combustion air and vent draft procedures are for natural draft and category I appliances equipped with a draft hood and connected to a natural draft venting system.

(1) *Preparing for Inspection.* Close all exterior building doors and windows and all interior doors between the space in which the appliance is located and other spaces of the building that can be closed. Turn on any clothes dryer. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they will operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers and any fireplace doors.

(2) *Placing the Appliance in Operation.* Place the appliance being inspected in operation. Adjust the thermostat or control so the appliance will operate continuously.

(3) *Spillage Test.* Verify that all appliances located within the same room are in their standby mode and ready for operation. Follow lighting instructions for each appliance as necessary. Test for spillage at the draft hood relief opening as follows:

  (a) After 5 minutes of main burner operation, check for spillage using smoke.

  (b) Immediately after the first check, turn on all other fuel gas burning appliances within the same room so they will operate at their full inputs and repeat the spillage test.

  (c) Shut down all appliances to their standby mode and wait for 15 minutes.

  (d) Repeat the spillage test steps (a) through (c) on each appliance being inspected.

(4) *Additional Spillage Tests:* Determine if the appliance venting is impacted by other door and air handler settings by performing the following tests:

  (a) Set initial test condition in accordance with G.5.2(1).

  (b) Place the appliance(s) being inspected in operation. Adjust the thermostat or control so the appliance(s) will operate continuously.

  (c) Open the door between the space in which the appliance(s) is located and the rest of the building. After 5 minutes of main burner operation, check for spillage at each appliance using smoke.

  (d) Turn on any other central heating or cooling air handler fan that is located outside of the area where the appliances are being inspected. After 5 minutes of main burner operation, check for spillage at each appliance using smoke. The test should be conducted with the door between the space in which the appliance(s) is located and the rest of the building in the open and in the closed position.

(5) Return doors, windows, exhaust fans, fireplace dampers, and any other fuel gas burning appliance to their previous conditions of use.

(6) If spillage occurs during testing, the owner should be notified, be instructed as to which configuration of the home would lessen its impact, and arrange for corrective action by an HVAC or venting professional. Where it is believed that the venting system performance is inadequate, the owner should be notified that alternative vent sizing, design, or configuration is needed in accordance with Chapters 12 and 13. Where it is believed that sufficient combustion air is not available, the owner should be notified that additional combustion air is needed in accordance with Section 9.3.

G.6 Appliance-Specific Inspections.

The following appliance-specific inspections are to be performed as part of a complete inspection. These inspections are performed either with the appliance in the off or standby mode (indicated by "*OFF*") or on an appliance that is operating (indicated by "*ON*"). The CO measurements are to be taken only after the appliance is determined to be venting properly. The CO detector should be capable of calculating CO emissions in ppm air free. Table G.6 contains CO thresholds for specific appliances.

Table G.6 CO Thresholds

Appliance	Threshold Limit
Central furnace (all categories)	400 ppm[a] air free[b,c]
Floor furnace	400 ppm air free
Gravity furnace	400 ppm air free
Wall furnace	200 ppm air free
Wall furnace (direct vent)	400 ppm air free
Vented room heater	200 ppm air free
Vent-free room heater	200 ppm air free
Boilers (all categories)	400 ppm air free
Water heater	200 ppm air free
Oven/Broiler	225 ppm as measured
Top burner	25 ppm as measured (per burner)
Clothes dryer	400 ppm air free
Refrigerator	25 ppm as measured
Gas log (gas fireplace)	25 ppm as measured in vent
Gas log (installed in wood-burning fireplace)	400 ppm air free in firebox

Notes:

[a]Parts per million

[b]Air-free emission levels are based on a mathematical equation (involving carbon monoxide and oxygen or carbon dioxide readings) to convert an actual diluted flue gas carbon monoxide testing sample to an undiluted air-free flue gas carbon monoxide level utilized in the appliance certification standards. For natural gas or propane, using as-measured CO ppm and O_2 percentage:

$$CO_{AFppm} = \left(\frac{20.9}{20.9 - O_2} \right) \times CO_{ppm} \quad \textbf{[G.6a]}$$

where:

CO_{AFppm} = Carbon monoxide, air-free ppm

CO_{ppm} = As-measured combustion gas carbon monoxide

O_2 = Percentage of oxygen in combustion gas, as a percentage

[c]An alternate method of calculating the CO air-free when access to an oxygen meter is not available:

$$CO_{(air-free)} = \frac{UCO_2}{CO_2}(CO) \quad \textbf{[G.6b]}$$

where:

UCO_2 = Ultimate concentration of carbon dioxide for the fuel being burned in percent for natural gas (12.2 percent) and propane (14.0 percent)

CO_2 = Measured concentration of carbon dioxide in combustion products in percent

CO = Measured concentration of carbon monoxide in combustion products in percent

G.6.1 Forced Air Furnaces.

(1) *OFF.* Verify that an air filter is installed and that it is not excessively blocked with dust.

(2) *OFF.* Inspect visible portions of the furnace combustion chamber for cracks, ruptures, holes, and corrosion. A heat exchanger leakage test should be conducted.

(3) *ON.* Verify that both the limit and fan controls are operating properly. Limit control operation can be checked by blocking the circulating air inlet or temporarily disconnecting the electrical supply to the blower motor and determining that the limit control acts to shut off the main burner gas.

(4) *ON.* Verify that the blower compartment door is installed properly and can be resecured properly if opened. Verify that the blower compartment door safety switch operates properly.

(5) *ON.* Check for flame disturbance before and after blower comes on, which can indicate heat exchanger leaks.

(6) *ON.* Measure the CO in the vent after 5 minutes of main burner operation. The CO should not exceed threshold in Table G.6.

G.6.2 Boilers.

(1) *OFF and ON.* Inspect for evidence of water leaks around boiler and connected piping.

(2) *ON.* Verify that the water pumps are in operating condition. Test low water cutoffs, automatic feed controls, pressure and temperature limit controls, and relief valves in accordance with the manufacturer's recommendations to determine that they are in operating condition.

(3) *ON*. Measure the CO in the vent after 5 minutes of main burner operation. The CO should not exceed threshold in Table G.6.

G.6.3 Water Heaters.

(1) *OFF.* Verify that the pressure-temperature relief valve is in operating condition. Water in the heater should be at operating temperature.

(2) *OFF.* Verify that inspection covers, glass, and gaskets are intact and in place on a flammable vapor ignition resistant (FVIR)–type water heater.

(3) *ON.* Verify that the thermostat is set in accordance with the manufacturer’s operating instructions and measure the water temperature at the closest tub or sink to verify that it is no greater than 120ºF.

(4) *OFF.* Where required by the local building code in earthquake-prone locations, inspect that the water heater is secured to the wall studs in two locations (high and low) using appropriate metal strapping and bolts.

(5) *ON.* Measure the CO in the vent after 5 minutes of main burner operation. The CO should not exceed threshold in Table G.6.

G.6.4 Cooking Appliances.

(1) *OFF.* Inspect oven cavity and range-top exhaust vent for blockage with aluminum foil or other materials.

(2) *OFF.* Inspect cook top to verify that it is free from a build-up of grease.

(3) *ON.* Measure the CO above each burner and at the oven exhaust vents after 5 minutes of burner operation. The CO should not exceed threshold in Table G.6.

G.6.5 Vented Room Heaters.

(1) *OFF.* For built-in room heaters and wall furnaces, inspect that the burner compartment is free of lint and debris.

(2) *OFF.* Inspect that furnishings and combustible building components are not blocking the heater.

(3) *ON.* Measure the CO in the vent after 5 minutes of main burner operation. The CO should not exceed threshold in Table G.6.

G.6.6 Vent-Free Heaters.

(1) *OFF.* Verify that the heater input is a maximum of 40,000 Btu/hr input, but not more than 10,000 Btu/hr where installed in a bedroom, and 6,000 Btu/hr where installed in a bathroom.

(2) *OFF.* Inspect the ceramic logs provided with gas log–type vent-free heaters to verify that they are located and aligned properly.

(3) *OFF.* Inspect the heater to verify that it is free of excess lint build-up and debris.

(4) *OFF.* Verify that the oxygen depletion safety shutoff system has not been altered or bypassed.

(5) *ON.* Verify that the main burner shuts down within 3 minutes by extinguishing the pilot light. The test is meant to simulate the operation of the oxygen depletion system (ODS).

(6) *ON.* Measure the CO after 5 minutes of main burner operation. The CO should not exceed threshold in Table G.6.

G.6.7 Gas Log Sets and Gas Fireplaces.

(1) *OFF.* For gas logs installed in wood-burning fireplaces equipped with a damper, verify that the fireplace damper is in a fixed open position.

(2) *ON.* Measure the CO in the firebox (log sets installed in wood burning fireplaces or in the vent [gas fireplace]) after 5 minutes of main burner operation. The CO should not exceed threshold in Table G.6.

G.6.8 Gas Clothes Dryer.

(1) *OFF.* Where installed in a closet, verify that a source of make-up air is provided and inspect that any make-up air openings, louvers, and ducts are free of blockage.

(2) *OFF.* Inspect for excess amounts of lint around the dryer and on dryer components. Verify that the lint trap is installed properly and that it does not have holes or tears. Verify that it is in a clean condition.

(3) *OFF.* Inspect visible portions of the exhaust duct and connections for loose fittings and connections, blockage, and signs of corrosion. Verify that the duct termination is not blocked and that it terminates in an outdoor location. Verify that only approved metal vent ducting material is installed (plastic and vinyl materials are not approved for gas dryers).

(4) *ON.* Verify mechanical components, including drum and blower, are operating properly.

(5) *ON.* Operate the clothes dryer and verify that exhaust system is intact and exhaust is exiting the termination.

(6) *ON.* Measure the CO at the exhaust duct or termination after 5 minutes of main burner operation. The CO should not exceed threshold in Table G.6.

Additional Proposed Changes

File Name	Description	Approved
TG_Final_2-22_NFPA_54_Annex_G_1_.docx	Annex G. Rewrite	

Statement of Problem and Substantiation for Public Comment

A complete rewrite of Annex G.5.2 is recommended by the task group on combustion air. The rewrite provides more accurate and comprehensive method for draft testing. The proposed method provides a means to consider more variables such as the impact of door closure, duct leakage, and testing sequence.

Related Item

• fr 36

Submitter Information Verification

Submitter Full Name: John Puskar
Organization: Prescient Technical Services L
Street Address:
City:
State:
Zip:
Submittal Date: Mon May 16 11:05:33 EDT 2022
Committee: NFG-AAA

Committee Statement

Committee Action: Rejected but see related SR
Resolution: SR-28-NFPA 54-2022
Statement: The rewrite provides more accurate and comprehensive method for draft testing. The proposed method provides a means to consider more variables such as the impact of door closure, duct leakage, and testing sequence.

NFPA 54 Annex G. Redraft

G.5.2 Test for Combustion Air and Vent Drafting for Natural Draft and Category I Appliances for single-zone constant volume systems.

Combustion air and vent draft procedures are for natural draft and category I appliances equipped with a draft hood and connected to a natural draft venting system.

(1) Preparation For Testing.

a. Close all exterior building doors and windows and other openings to the outdoors.
b. Close solid-fuel burning appliances and fireplace dampers and combustion air controls.
c. Remove or replace the forced air heating/cooling system air filter.
d. Open heating/cooling supply air registers outside of the combustion appliance zone and close supply air registers within the combustion appliance. The combustion appliance zone in the room or space in which the appliance(s) to be tested Is located.
e. Close all interior doors except those to rooms that contain an exhaust fan or air exhausting appliance.
f. Operate all exhaust fans, air exhausting appliances and appliance mechanical draft exhausters at maximum capacity.
g. Clean filters and exhaust terminals of air exhausting appliances.
h. Do not operate summer exhaust fans.

(2) Measuring Combustion Appliance Zone Pressure.

a. Set up a manometer to measure the combustion appliance zone pressure with reference to the outdoors.
b. Obtain two combustion appliance zone pressure measurements (a total of two data points) with the heating/cooling system air handler(s) not operating.
i. One with the entrance/exit doors to the combustion appliance zone room open
ii. One with the entrance/exit doors to the combustion appliance zone room closed
c. Operate any heating/cooling system air handler at the maximum speed at which it Is expected to operate.
d. Obtain two combustion appliance zone pressure measurements (a total of 2 data points).
i. One with the entrance/exit doors to the combustion appliance zone room open
ii. One with the entrance/exit doors to the combustion appliance zone room closed
e. The most negative pressure in the combustion appliance zone, referenced to the outdoors, shall be considered to be the most negative depressurization case.

(3) Placing the Appliance in Operation.

a. Configure the building in the identified most negative pressure referenced to the outdoors of the 4 data points recorded in steps 2 (b) and (d).
b. Verify that all appliances located within the same room are in their standby mode

and ready for operation.
c. Start with the lowest Btuh input appliance in the space.
d. Place the appliance being tested in operation. Adjust the thermostat or control so that the appliance will operate continuously
e. Spillage Test. Test for spillage at the draft hood relief opening according to the appliance manufacturers' instructions. It is recommended, for personnel safety, to monitor ambient carbon monoxide (CO) levels in the space in which the testing is being conducted. Do not continue testing in an environment with more than 50 ppm (OSHA 8 hour time-weighted average limit) for Carbon monoxide exposure. Carbon Monoxide has cumulative effects, and multiple exposures can be dangerous. CO can cause headaches, dizziness, mental dullness, weakness, sleepiness, nausea, vomiting, unconsciousness, and death [Fire Protection Guide to Hazardous Materials, 14th edition, NFPA]. Persons who exhibit these signs after exposure should seek medical attention immediately.

(4) Draft Testing
If the manufacturer's instructions for draft spillage testing are not available, test as follows:
a. After 5 minutes of main burner operation, check for spillage using smoke or a mirror for fogging.

c. Immediately after the first check, turn on all other fuel gas burning appliances that obtain combustion air from indoors so that they will operate at their full inputs and repeat the spillage test for each appliance to make sure that there is no spillage as all appliances operate together.

(5) After Appliance Testing is Complete:
a. Return doors, windows, exhaust fans, heating/cooling system air handlers, fireplace dampers, and other fuel gas burning appliances to their previous conditions prior to preparation for testing.

(6) Owner Warning, Draft Testing Failures
If spillage occurs during draft testing, the owner must be notified in writing, and the owner must be instructed to arrange for corrective action by an HVAC or venting professional before the systems are again operated.

Public Comment No. 1-NFPA 54-2022 [New Section after G.5.2]

G.5.2 Test for Combustion Air and Vent Drafting for Natural Draft and Category I

Appliances for single-zone constant volume systems.

Combustion air and vent draft procedures are for natural draft and category I appliances equipped with a draft hood and connected to a natural draft venting system.

(1) Preparation For Testing.

a. Close all exterior building doors and windows and other openings to the outdoors.

b. Close solid-fuel burning appliance and fireplace dampers and combustion air controls.

c. Remove or replace the forced air heating/cooling system air filter.

d. Open heating/cooling supply air registers outside of the combustion appliance zone and close supply air registers within the combustion appliance zone. The combustion appliance zone is the room or space in which the appliance(s) to be tested Is located.

e. Close all interior doors except those to rooms that contain an exhaust fan or air exhausting appliance.

f. Clean filters and exhaust terminals of air-exhausting appliances.

g. Operate all exhaust fans, air exhausting appliances, and appliance mechanical draft exhausters at maximum capacity.

h. Do not operate summer exhaust fans.

(2) Measuring Combustion Appliance Zone Pressure.

a. Set up a manometer to measure the combustion appliance zone pressure with reference to the outdoors.

b. Obtain two combustion appliance zone pressure measurements (a total of two data points) with the heating/cooling system air handler(s) not operating.

i. One with the entrance/exit doors to the combustion appliance zone room open

ii. One with the entrance/exit doors to the combustion appliance zone room

closed

c. Operate any heating/cooling system air handler at the maximum speed at which it is expected to operate.

d. Obtain two combustion appliance zone pressure measurements (a total of 2 data points).

i. One with the entrance/exit doors to the combustion appliance zone room open

ii. One with the entrance/exit doors to the combustion appliance zone room closed

e. The most negative pressure in the combustion appliance zone, referenced to the outdoors, shall be considered to be the most negative depressurization case.

(3) Placing the Appliance in Operation.

a. Configure the building in the identified most negative pressure referenced to the outdoors of the 4 data points recorded in steps 2 (b) and (d).

b. Verify that all appliances located within the same room are in their standby mode and ready for operation.

c. Start with the lowest Btuh input appliance in the space.

d. Place the appliance being tested in operation. Adjust the thermostat or control so that the appliance will operate continuously

e. Spillage Test. Test for spillage at the draft hood relief opening according to the appliance manufacturers' instructions. It is recommended, for personnel safety, to monitor ambient carbon monoxide (CO) levels in the space in which the testing is being conducted. Do not continue testing in an environment with more than 50 ppm (OSHA 8 hour time-weighted average limit) for carbon monoxide exposure. Carbon monoxide has cumulative effects, and multiple exposures can be dangerous. Carbon monoxide can cause headaches, dizziness, mental dullness, weakness, sleepiness, nausea, vomiting, unconsciousness, and death [Fire Protection Guide to Hazardous Materials, 14 th edition, NFPA]. Persons who exhibit these signs after exposure should seek medical attention immediately.

(4) Draft Testing

If the manufacturer's instructions for draft spillage testing are not available, test as follows:

a. After 5 minutes of main burner operation, check for spillage using smoke or a mirror for fogging.

b. Immediately after the first check, turn on all other fuel gas burning appliances that obtain combustion air from indoors so that they will operate at their maximum inputs and repeat the spillage test for each appliance to make sure that there is no spillage as all appliances operate together.

(5) After Appliance Testing is Complete:

a. Return doors, windows, exhaust fans, heating/cooling system air handlers, fireplace dampers, and other fuel gas burning appliances to their previous conditions prior to preparation for testing.

(6) Owner Warning, Draft Testing Failures

If spillage occurs during draft testing, the owner must be notified in writing, and the owner must be instructed to arrange for corrective action by an HVAC or venting professional before the systems are again operated.

Statement of Problem and Substantiation for Public Comment

Work product of combustion air task group.

Related Item

• 54 TG combustion air

Submitter Information Verification

Submitter Full Name: John Puskar
Organization: Prescient Technical Services L
Street Address:
City:
State:
Zip:
Submittal Date: Fri Feb 25 09:36:20 EST 2022
Committee: NFG-AAA

Committee Statement

Committee Action: Rejected but see related SR

Resolution: SR-28-NFPA 54-2022

Statement: The rewrite provides more accurate and comprehensive method for draft testing. The proposed method provides a means to consider more variables such as the impact of door closure, duct leakage, and testing sequence.