NFPA No.

54

ANSI Z21.30
1969

INSTALLATION OF

# GAS APPLIANCES GAS PIPING 1969

**An American National Standard**


$1.25



NATIONAL FIRE PROTECTION ASSOCIATION
International

60 Batterymarch Street, Boston, Mass. 02110

20M-8-72-SM-NP(70M)
Printed in U.S.A.

## Official NFPA Definitions

Adopted Jan. 23, 1964: Revised Dec. 9, 1969. Where variances to these definitions are found, efforts to eliminate such conflicts are in process.

SHALL is intended to indicate requirements.

SHOULD is intended to indicate recommendations or that which is advised but not required.

APPROVED means acceptable to the authority having jurisdiction. The National Fire Protection Association does not approve, inspect or certify any installations, procedures, equipment or materials nor does it approve or evaluate testing laboratories. In determining the acceptability of installations or procedures, equipment or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure or use. The authority having jurisdiction may also refer to the listings or labeling practices of nationally recognized testing laboratories,* i.e., laboratories qualified and equipped to conduct the necessary tests, in a position to determine compliance with appropriate standards for the current production of listed items, and the satisfactory performance of such equipment or materials in actual usage.

*Among the laboratories nationally recognized by the authorities having jurisdiction in the United States and Canada are the Underwriters' Laboratories, Inc., the Factory Mutual Research Corp., the American Gas Association Laboratories, the Underwriters' Laboratories of Canada, the Canadian Standards Association Testing Laboratories, and the Canadian Gas Association Approvals Division.

LISTED: Equipment or materials included in a list published by a nationally recognized testing laboratory that maintains periodic inspection of production of listed equipment or materials, and whose listing states either that the equipment or material meets nationally recognized standards or has been tested and found suitable for use in a specified manner.

LABELED: Equipment or materials to which has been attached a label, symbol or other identifying mark of a nationally recognized testing laboratory that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling is indicated compliance with nationally recognized standards or tests to determine suitable usage in a specified manner.

AUTHORITY HAVING JURISDICTION: The organization, office or individual responsible for "approving" equipment, an installation, or a procedure.

## Statement on NFPA Procedures

This material has been developed in the interest of safety to life and property under the published procedures of the National Fire Protection Association. These procedures are designed to assure the appointment of technically competent Committees having balanced representation from those vitally interested and active in the areas with which the Committees are concerned. These procedures provide that all Committee recommendations shall be published prior to action on them by the Association itself and that following this publication these recommendations shall be presented for adoption to the Annual Meeting of the Association where anyone in attendance, member or not, may present his views. While these procedures assure the highest degree of care neither the National Fire Protection Association, its members, nor those participating in its activities accepts any liability resulting from compliance or noncompliance with the provisions given herein, for any restrictions imposed on materials or processes, or for the completeness of the text.

Standard for the Installation of

# Gas Appliances and Gas Piping

NFPA No. 54 - 1969

## 1969 Edition of No. 54

This edition of NFPA No. 54 supersedes the 1964 edition. It incorporates amendments recommended by the Committee on Fuel Gases and adopted at the 1969 Annual Meeting on May 13, 1969.

This standard is also ANSI Z21.30.

Changes, other than editorial, are denoted by a vertical line in the margin of the pages in which they appear, except as follows:

(a) Part 5 has been completely revised.

(b) Appendix B has been expanded.

## Origin and Development of No. 54

This standard originated with the adoption of a fire protection code for city gas installations by the NFPA in 1920. Revisions were adopted in 1930, 1932, 1940, 1941 and 1943. The 1932 edition was adopted by the American Standards Association (predecessor of the United States of America Standards Institute) in 1933 as "American Recommended Practice for the Installation, Maintenance and Use of Piping and Fittings for City Gas, Z27."

Concurrently with this activity, the American Gas Association (and its predecessors) developed a standard for gas house piping and appliance installation which was adopted by the AGA in 1928 and revised in 1940.

Following World War II, cooperation between NFPA and AGA resulted in replacement of Z27 and the AGA standard with the first edition of NFPA No. 54 — ASA Z21.30, "American Standard Installation of Gas Appliances and Piping in Buildings (not applicable to undiluted liquefied petroleum gas)" in 1950. The standard was revised in 1954.

A similar standard applicable to undiluted liquefied petroleum gas was published by NFPA, as NFPA No. 52, in 1953 and 1956 editions. This standard was incorporated into the 1959 edition of NFPA No. 54 — ASA Z21.30. The combined standard was revised in 1964.

Since the 1950 edition, preparation of this standard has been a cooperative effort between the NFPA Committee on Fuel Gases (and its predecessors) and USA Standards Committee Z21 and its Subcommittee Z21.30.

### Interpretation Procedure for the Committee on Fuel Gases

Those desiring an interpretation shall supply the Chairman with five identical copies of a statement in which shall appear specific reference to a single problem, paragraph, or section. Such a statement shall be on the business stationery of the inquirer and shall be duly signed.

When applications involve actual field situations they shall so state and all parties involved shall be named.

The Interpretations Committee will reserve the prerogative to refuse consideration of any application that refers specifically to proprietary items of equipment or devices. Generally inquiries should be confined to interpretation of the literal text or the intent thereof.

Requests for interpretations should be addressed to the National Fire Protection Association, 60 Batterymarch Street, Boston, Massachusetts 02110.

# Committee on Fuel Gases

**L. E. Henry,** Chairman,
Southern California Gas Co., Box 3249, Terminal Annex, Los Angeles, Calif. 90054
(rep. American Gas Association)

**W. L. Walls,†** Secretary,
National Fire Protection Assn., 60 Batterymarch St., Boston, Mass. 02110

**C. E. Blome,** Gas Appliance Manufacturers Assn., Inc.
**W. M. Cline,** American Iron & Steel Institute
**E. Doe,** Fire Marshals Assn. of North America
**W. H. Doyle,** Factory Insurance Association
**A. F. Dyer,** American Petroleum Institute
**L. H. Flanders,** Factory Mutual Engineering Assn.
**Robert E. Gresimer,** Fire Marshals Assn. of North America
**Howard Haighes, Jr.,** U.S. Dept. of the Interior, National Park Service
**F. E. Hodgdon,** American Gas Association, Inc.
**E. G. Howick,** National LP-Gas Assn.
**H. T. Jones,** Ontario Department of Energy and Resources Management
**H. V. Keepers,** Fire Prevention and Engineering Bureau of Texas
**Wallace D. Malmstedt,** American Insurance Assn.
**D. S. Martin,** Underwriters' Laboratories of Canada
**M. M. McMahon,** American Gas Association
**Bennett Selekof,** New York State Building Codes Bureau
**W. J. Smith,** Underwriters' Laboratories, Inc.
**H. Emerson Thomas,** National LP-Gas Assn.
**J. L. Thompson,** Kentucky Inspection Bureau

**Alternates**

**W. H. Johnson,** National LP-Gas Assn. (Alternate to E. G. Howick and H. E. Thomas)
**A. A. Mulliken, Jr.,** American Petroleum Institute (Alternate to A. F. Dyer)
**A. Santos,** Factory Mutual Engineering Assn. (Alternate to L. H. Flanders)
**W. Roger Sarno,** American Gas Association (Alternate to L. E. Henry, F. E. Hodgdon, M. M. McMahon)
**R. I. Spencer,** Factory Insurance Assn. (Alternate to W. H. Doyle)
**J. H. Witte,** Underwriters' Laboratories, Inc. (Alternate to W. J. Smith)

† Nonvoting

SCOPE: To develop fire safety codes, standards, recommended practices, and manuals, as may be considered desirable, covering the installation of piping and appliances using fuel gases such as natural gas, manufactured gas, liquefied petroleum gas, and liquefied petroleum gas-air mixtures, for heating, cooking and lighting, and the storage and handling of fuel gases (in gaseous and liquid phases) at utility gas plants. Exceptions are the use of fuel gas in cutting and welding applications (covered by the Committee on Industrial and Medical Gases) and the applications of liquefied petroleum gas covered by the Committee on Liquefied Petroleum Gases.

# Standard for the Installation of Gas Appliances and Gas Piping

## NFPA No. 54 - 1969

### Contents

# Part 1 — General

## 1.1 *SCOPE*

### 1.1.1 Applicability:

This standard applies to the installation of nonindustrial type gas appliances and to the design, fabrication, installation and tests of nonindustrial piping systems for fuel gases such as natural gas, manufactured gas, undiluted liquefied petroleum gases, liquefied petroleum gas-air mixtures, or mixtures of any of these gases, as follows:

(a) Low pressure (not in excess of ½ pound per square inch or 14 inches water column) piping systems extending from the outlet of the meter set assembly, or the outlet of the service regulator when a meter is not provided, to the inlet connections of appliances.

(b) The installation of appliances supplied at pressures of ½ pound per square inch or less.

### 1.1.2 Nonapplicability:

This standard does not apply to:

(a) Gas piping systems for industrial installations at any pressure or any other gas piping system operating at pressures greater than ½ pound per square inch. Piping in such installations shall be installed in accordance with good practices.[1]

(b) Gas equipment supplied through piping systems covered in 1.1.2(a), and

(c) Gas equipment designed and installed for specific manufacturing, production, processing and power generating application.

### 1.1.3 Other Standards:

In applying this standard, reference should also be made to the manufacturer's instructions and the serving gas supplier regulations.

---

[1] USA Standard Installation of Gas Piping and Gas Equipment on Industrial Premises and Certain Other Premises, Z83.1-1968 or NFPA No. 54A-1969, may be used as a guide. This standard is available from the National Fire Protection Association, the United States of America Standards Institute, 10 East 40th Street, New York, New York 10016, or the American Gas Association, Inc., Laboratories, 1032 East 62nd St., Cleveland, Ohio 44103.

Also see

(a) USA Standard for the Storage and Handling of Liquefied Petroleum Gases, Z106.1-1969 (NFPA No. 58-1969).[2,4]

(b) Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines, NFPA No. 37-1967.[4]

(c) Standard on Incinerators, NFPA No. 82-1969.[4]

(d) Standard for Prevention of Furnace Explosions in Fuel Oil—and Natural Gas-Fired Watertube Boiler-Furnaces with One Burner, NFPA No. 85-1967.[4]

(e) Standard for Ovens and Furnaces—Design, Location, and Equipment, NFPA No. 86A-1969.[4]

(f) USA Standard Requirements for Installation of Gas-Burning Equipment in Large Boilers, Z21.33-1950.[2,3]

(g) USA Standard for Mobile Homes, A119.1-1969 (NFPA No. 501B-1968).[2]

(h) USA Standard Installation of Plumbing, Heating and Electrical Systems in Travel Trailers, A119.2-1963.[2]

(i) Other standards as referred to in this standard.

### 1.1.4 "Approved:"

The word "approved," as used in this standard, means acceptable to the authority having jurisdiction.

## 1.2 *QUALIFIED INSTALLING AGENCY*

Installation and replacement of gas piping or gas appliances and repair of gas appliances shall be performed only by a qualified installing agency. By the term "qualified installing agency" is meant any individual, firm, corporation, or company which either in person or through a representative is engaged in and is responsible for the installation or replacement of gas piping on the outlet side of the meter, or of the service regulator when a meter is not provided, or the connection, installation or repair of gas appliances, who is experienced in such work, familiar with all precautions required, and has complied with all the requirements of the authority having jurisdiction.

---

[2] Available from the United States of America Standards Institute, 10 East 40th Street, New York, New York 10016.

[3] Available from American Gas Association, Inc., Laboratories, 1032 East 62nd St., Cleveland, Ohio 44103.

[4] Available from the National Fire Protection Association, 60 Batterymarch Street, Boston, Mass. 02110.

## 1.3 *GENERAL PRECAUTIONS*

### 1.3.1 Turn Gas Off:

All gas piping or gas appliance installation shall be performed with the gas turned off to eliminate hazards from leakage of gas.

### 1.3.2 Notification of Interrupted Service:

It shall be the duty of the installing agency when the gas supply is to be turned off, to notify all affected consumers.

### 1.3.3 Before Turning Gas Off:

Before turning off the gas to premises for the purpose of installation, repair, replacement or maintenance of gas piping or appliances, all burners shall be turned off. When two or more consumers are served from the same supply system, precautions shall be exercised to assure that only service to the proper consumer is turned off.

### 1.3.4 Checking for Gas Leaks:

Soap and water solution, or other material acceptable for the purpose, shall be used in locating gas leakage. *Matches, candles, flame or other sources of ignition shall not be used for this purpose.*

### 1.3.5 Use of Lights:

Artificial illumination used in connection with a search for gas leakage shall be restricted to electric hand flashlights (preferably of the safety type) or approved safety lamps. In searching for leaks, electric switches should not be operated. If electric lights are already turned on, they should not be turned off.

### 1.3.6 Working Alone:

An individual shall not work alone in any situation where accepted working practice dictates that two or more men are necessary to perform the work safely.

### 1.3.7 Handling of Liquid from Drips:

Liquid which is removed from a drip in existing gas piping shall be handled with proper precautions, and shall not be left on the consumer's premises.

### 1.3.8 No Smoking:

When working on piping which contains or has contained gas, smoking shall not be permitted.

### 1.3.9 Handling Flammable Liquids:

Flammable liquids used by the installer shall be handled with

proper precautions and shall not be left within the premises from the end of one working day to the beginning of the next.

### 1.3.10 Work Interruptions:

When interruptions in work occur, the system shall be left in a safe and satisfactory condition.

# Part 2 — Gas Piping Installation

## 2.1 *PIPING PLAN*

It is recommended that before proceeding with the installation of a gas piping system, a piping sketch or plan be prepared showing the proposed location of the piping as well as the size of different branches. Adequate consideration should be given to future demands, and provisions made for added gas service.

Before any final plans or specifications are completed, the serving gas supplier or the authority having jurisdiction should be consulted.

When an additional appliance is to be served through any present gas piping, capacity of the existing piping shall be checked for adequacy, and replaced with larger piping if necessary.

## 2.2 *PROVISION FOR METER LOCATION*

The meter location shall be such that the meter can be easily read and the connections are readily accessible for servicing. Location, space requirements, dimensions, and type of installation shall be acceptable to the serving gas supplier.

Gas piping at multiple meter installations shall be plainly marked by a metal tag or other permanent means attached by the installing agency, designating the building or the part of the building being supplied.

## 2.3 *INTERCONNECTIONS*

### 2.3.1 Interconnections Supplying Separate Consumers:

When two or more meters, or two or more service regulators when meters are not provided, are installed on the same premises and supply separate consumers, the gas piping systems shall not be interconnected on the outlet side of the meters or service regulators.

### 2.3.2 Interconnections for Stand-By Fuels:

When a supplementary gas for stand-by use is connected downstream from a meter or a service regulator when a meter is not provided, a suitable device to prevent backflow shall be installed. A three-way valve installed to admit the stand-by supply and at the same time shut off the regular supply may be used for this purpose.

## 2.4 *SIZE OF PIPING TO GAS APPLIANCES*

### 2.4.1 Size of Supply Piping for Gas Appliances:

Gas piping shall be of such size and so installed as to provide a supply of gas sufficient to meet the maximum demand without

undue loss of pressure between the meter, or service regulator when a meter is not provided, and the appliance or appliances. The size of gas piping depends upon the following factors:

(a) Allowable loss in pressure from meter, or service regulator when a meter is not provided, to appliance.

(b) Maximum gas consumption to be provided.

(c) Length of piping and number of fittings.

(d) Specific gravity of the gas.

(e) Diversity factor.

### 2.4.2 Gas Consumption:

The quantity of gas to be provided at each outlet shall be determined, whenever possible, directly from the manufacturer's Btu rating of the appliance which will be installed. In case the ratings of the appliances to be installed are not known, Table 1 of Appendix B shows the approximate consumption of average appliances of certain types.

### 2.4.3 Gas Piping Size:

The gas-carrying capacities for different sizes and lengths of iron pipe, or equivalent rigid pipe, and semirigid tubing are shown in capacity tables given in Appendix B. The serving gas supplier shall designate which Table(s) shall be used.

For any gas piping system, for special gas appliances or for conditions other than those covered by the capacity tables in Appendix B, such as longer runs, greater gas demands, or greater pressure drops, the size of each gas piping system shall be determined by standard engineering methods acceptable to the authority having jurisdiction and the serving gas supplier.

### 2.4.4 Diversity Factor:

The diversity factor (see Part 7, Definitions) is an important factor in determining the correct gas piping size to be used in multiple family dwellings. It is dependent upon the number and kinds of gas appliances being installed. Consult the serving gas supplier or the authority having jurisdiction for the diversity factor to be used.

### 2.4.5 Additions to Existing Gas Piping:

Additions to existing utility gas piping shall conform to the ca-

pacity table(s) in Appendix B that are designated by the serving gas supplier. Additions to existing undiluted liquefied petroleum gas piping shall conform to Table 7 or 8 of Appendix B. Existing gas piping that does not conform to these provisions shall be replaced by the proper size of pipe or tubing. Additions shall not be made to existing pipe or tubing which is smaller than that permitted by the applicable capacity table in Appendix B.

## 2.5 *GAS PIPING IN MOBILE HOME AND RECREATIONAL VEHICLE PARKS*

Gas piping systems in mobile home and recreational vehicle parks extending from the outlet of a meter set assembly or the outlet of a service regulator when a meter is not provided to the terminal of the gas riser at each site shall comply with the following specific provisions and with all other applicable provisions in Part 1 and Part 2 of this standard.

### 2.5.1 Protection of Piping:

Piping shall be buried to a sufficient depth or covered in a manner so as to protect the piping system from physical damage.

### 2.5.2 Prohibited Locations:

Piping shall not be installed underground beneath mobile homes or recreational vehicles with an enclosing foundation.

### 2.5.3 Location, Protection and Sizing of Riser:

A gas riser to each site shall be placed in the rear one-third section of the site and not less than 18 inches from the roadside wall of the mobile home or recreational vehicle. An additional riser may be placed on the site to service the hitch gas supply connection. The gas riser(s) shall be located and protected or supported so as to minimize the likelihood of damage by moving vehicles. The minimum size of the gas piping outlet at a site shall be ¾ inch for other than undiluted liquefied petroleum gases.

### 2.5.4 Location of Shutoff Valves:

(a) Outlets for the individual sites and gas piping to any building supplied by the system shall be provided with a readily accessible approved valve which cannot be locked in the open position.

(b) A readily accessible valve shall be provided near the point of gas delivery for shutting off the entire park system. The valve provided by the serving gas supplier may be considered acceptable for this purpose provided it is readily accessible.

### 2.5.5 Connections:

Connections to the gas piping system shall be made with pipe, listed connectors or semirigid tubing. Provisions for flexibility shall be provided when necessary. Connectors having aluminum exterior surfaces shall not be used.

### 2.5.6 Demand Factors:

(a) The hourly volume of gas required for any site gas outlet or any section of a park gas piping system may be computed from Table 9 of Appendix B.

(b) Other gas equipment or appliances, other than site outlets, shall be computed at the manufacturer's maximum cubic foot per hour input rating or from Table 1 of Appendix B and shall be added to the figures given in Table 9 of Appendix B.

## 2.6 *ACCEPTABLE PIPING MATERIALS*

### 2.6.1 Piping Materials:

(a) METALLIC PIPE; PIPING JOINTS AND FITTINGS. Metallic gas pipe shall be steel or wrought-iron pipe complying with the USA Standard for Wrought-Steel and Wrought-Iron Pipe, B36.10-1959.* Threaded copper, brass, or aluminum alloy pipe in iron pipe sizes may be used with gases not corrosive to such material. Aluminum alloy pipe shall be factory coated to protect against external corrosion where it is in contact with masonry, plaster, or insulation or is subject to repeated wettings by such liquids as water (except rain water), detergents or sewage. Aluminum alloy pipe shall not be used in exterior locations or underground. Aluminum alloy pipe shall comply with the USA Standard Specification for Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube, H38.7-1967 (ASTM B241-673)** (except that the use of alloy 5456 is prohibited), and shall be suitably marked at each end of each length indicating compliance with the standard.

Metallic pipe joints may be screwed, flanged or welded, and nonferrous metallic pipe may also be soldered or brazed with material having a melting point in excess of 1,000° F.

---

*Available from the United States of America Standards Institute, 10 East 40th St., New York, New York 10016.

**Available from the United States of America Standards Institute, 10 East 40th St., New York, New York 10016, or the American Society for Testing and Materials, 1916 Race St., Philadelphia, Pennsylvania 19103.

Metallic fittings (except stopcocks or valves) shall be steel, brass, or malleable or ductile iron when used with steel or wrought-iron pipe, and shall be copper or brass when used with copper or brass pipe, and shall be aluminum alloy when used with aluminum alloy pipe. When approved by the authority having jurisdiction, special fittings, such as saddle tees and gland type compression couplings, may be used to connect steel or wrought-iron pipe. Cast-iron fittings in sizes 6 inches and larger may be used to connect steel and wrought-iron pipe when approved by the authority having jurisdiction.

(b) METALLIC TUBING; TUBING JOINTS AND FITTINGS. When acceptable to the serving gas supplier, seamless copper, aluminum alloy or steel tubing may be used with gases not corrosive to such material. Copper tubing shall comply with standard Type K or L, of the USA Standard Specification for Seamless Copper Watertube, H23.1-1967 (ASTM B88-66a)** or the USA Standard Specification for Seamless Copper Tube for Refrigeration Field Service, H23.5-1967 (ASTM B280-66a).** Steel tubing shall comply with the Specification for Electric-Resistance-Welded Coiled Steel Tubing for Gas and Fuel Oil Lines, ASTM A539-65,*** or USA Standard Specification for Copper Brazed Steel Tubing, B36.35-1966 (ASTM A254-64).** Aluminum alloy tubing shall be of standard Type A or B, or equivalent, complying with USA Standard Specification for Aluminum-Alloy Drawn Seamless Tubes, H38.3-1967 (ASTM B210-67),** or Type A or equivalent complying with USA Standard Specification for Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube, H38.7-1967 (ASTM B241-67).** Aluminum alloy tubing shall be factory coated to protect against external corrosion where it is in contact with masonry, plaster, or insulation or is subject to repeated wettings by such liquids as water (except rain water), detergents or sewage. Aluminum alloy tubing shall not be used in exterior locations or underground.

Metallic tubing joints shall either be made with approved gas tubing fittings, or be soldered or brazed with a material having a melting point in excess of 1,000° F. Metallic ball sleeve compression type tubing fittings shall not be used for this purpose.

(c) PLASTIC PIPE, TUBING AND FITTINGS. When acceptable to the serving gas supplier, plastic pipe or tubing conforming with specification ASTM D2513-68, Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings,*** or specification ASTM D2517-67, Specification for Reinforced Thermosetting Plastic Gas

***Available from the American Society for Testing and Materials, 1916 Race St., Philadelphia, Pennsylvania 19103.
**See page 54-13.

Pressure Piping and Fittings,*** and compatible fittings may be used for outside piping underground only.

The installation shall be such as to avoid excessive stresses due to thermal contraction.

Plastic pipe, tubing and fittings shall be joined by either the solvent cement method, adhesive method, heat-fusion method, or by means of compression couplings or flanges. The joining method used shall be compatible with the materials being joined. The recommendations of the manufacturer shall also be taken into consideration when determining which method is to be used.

The following shall be observed when making such joints:

1. Plastic pipe or tubing shall not be threaded.

2. Solvent cement joints, adhesive joints, and heat-fusion joints shall be made in accordance with qualified procedures which have been established and proven by test to produce gas-tight joints at least as strong as the pipe or tubing being joined.

3. Solvent cement or heat-fusion joints shall not be made between different kinds of plastics.

4. Heat-fusion or mechanical joints shall be used when joining polyethylene pipe, tubing or fittings.

5. Flanges, flared joints, or special joints may be used providing they are properly qualified and utilized.

6. When compression type mechanical joints are used, the gasket material in the fitting shall be compatible with the plastic piping and with the gas distributed by the system. An internal tubular rigid stiffener shall be used in conjunction with the fitting and the stiffener shall be flush with end of the pipe or tubing and extend at least to the outside end of the compression fitting when installed. The stiffener shall be free of rough or sharp edges and shall not be a force fit in the plastic. A split tubular stiffener shall not be used.

7. The joint shall be designed and installed to effectively sustain the longitudinal pull-out forces caused by contraction of the piping or by external loading.

### 2.6.2 Workmanship and Defects:

Gas pipe or tubing and fittings shall be clear and free from cutting burrs and defects in structure or threading and shall be thoroughly brushed, and chip and scale blown.

Defects in pipe or tubing or fittings shall not be repaired. When

***See page 54-13.

defective pipe, tubing or fittings are located in a system the defective material shall be replaced.

### 2.6.3 Pipe Coating:

When in contact with material exerting a corrosive action, metallic piping and fittings coated with a corrosion resisting material shall be used.

### 2.6.4 Use of Old Piping Material:

Pipe, tubing, fittings, and valves removed from any existing installation shall not be again used until they have been thoroughly cleaned, inspected and ascertained to be equivalent to new material.

### 2.6.5 Joint Compounds:

Joint compounds shall be resistant to the action of liquefied petroleum gases.

## 2.7 *METALLIC PIPE THREADS*

### 2.7.1 Specifications for Metallic Pipe Threads:

Metallic pipe and fitting threads shall comply with the USA Standard for Pipe Threads (Except Dryseal), B2.1-1960.*

### 2.7.2 Damaged Threads:

Metallic pipe with threads which are stripped, chipped, corroded, or otherwise damaged shall not be used.

### 2.7.3 Number of Threads:

Metallic pipe shall be threaded in accordance with Table 1.

## 2.8 *CONCEALED PIPING IN BUILDINGS*

### 2.8.1 General:

Gas piping may be installed in concealed locations in accordance with this section.

### 2.8.2 Piping in Partitions:

Concealed gas piping should be located in hollow rather than solid partitions. Tubing shall not be run inside walls or partitions unless protected against physical damage. This rule does not apply to tubing which passes through walls or partitions.

---

*Available from the United States of America Standards Institute, 10 East 40th St., New York, New York 10016.

**Table 1**
**Specifications for Threading Metallic Pipe**

| Iron Pipe Size (Inches) | Approximate Length of Threaded Portion (Inches) | Approximate No. of Threads to be Cut |
|---|---|---|
| 1/2 | 3/4 | 10 |
| 3/4 | 3/4 | 10 |
| 1 | 7/8 | 10 |
| 1 1/4 | 1 | 11 |
| 1 1/2 | 1 | 11 |
| 2 | 1 | 11 |
| 2 1/2 | 1 1/2 | 12 |
| 3 | 1 1/2 | 12 |
| 4 | 1 5/8 | 13 |

### 2.8.3 Piping in Floors:

(a) Except as provided in 2.8.3(b), gas piping in solid floors such as concrete shall be laid in channels in the floor suitably covered to permit access to the piping with a minimum of damage to the building. When piping in floor channels may be exposed to excessive moisture or corrosive substances, it shall be suitably protected.

(b) When approved by the authority having jurisdiction and acceptable to the serving gas supplier, gas piping may be embedded in concrete floor slabs constructed with portland cement. Piping shall be surrounded with a minimum of 1½ inches of concrete and shall not be in physical contact with other metallic structures such as reinforcing rods or electrical neutral conductors. When piping may be subject to corrosion at point of entry into concrete slab, it shall be suitably protected from corrosion. Piping shall not be embedded in concrete slabs containing quickset additives or cinder aggregate.

### 2.8.4 Connections in Original Installations:

When installing gas piping which is to be concealed, unions, tubing fittings, running threads, right and left couplings, bushings, and swing joints made by combinations of fittings shall not be used.

### 2.8.5 Reconnections:

When necessary to insert fittings in gas pipe which has been installed in a concealed location, the pipe may be reconnected by use of a ground joint union with the nut center-punched to prevent loosening by vibration. Reconnection of tubing in a concealed location is prohibited.

## 2.9 *PIPING UNDERGROUND*

### 2.9.1 Protection of Piping:

Piping shall be buried a sufficient depth or covered in a manner so as to protect the piping from physical damage. Consideration should be given to protecting the piping from physical damage when it passes through flower beds, shrub beds, and other such cultivated areas.

### 2.9.2 Connection of Plastic Piping:

Connections between metallic and plastic piping shall be made outside underground.

### 2.9.3 Protection Against Corrosion:

Gas piping in contact with material which will corrode the piping shall be protected against corrosion in an approved manner. When dissimilar metals are joined underground, an insulated coupling shall be used. Metallic piping shall not be laid in contact with cinders.

### 2.9.4 Piping Through Foundation Wall:

Underground gas piping, when installed below grade through the outer foundation or basement wall of a building, shall be either encased in a sleeve or otherwise protected against corrosion. The piping or sleeve shall be sealed at the foundation or basement wall to prevent entry of gas or water.

### 2.9.5 Piping Underground Beneath Buildings:

When the installation of gas piping underground beneath buildings is unavoidable, the piping shall be encased in a conduit. The conduit shall extend into a normally usable and accessible portion of the building and, at the point where the conduit terminates in the building, the space between the conduit and the gas piping shall be sealed to prevent the possible entrance of any gas leakage. The conduit shall extend at least 4 inches outside the building, be vented above grade to the outside and be installed in a way as to prevent the entrance of water.

## 2.10 *INSTALLATION OF PIPING*

Drips, grading, protection from freezing, and branch pipe connections, as provided for in 2.10.2, 2.10.4, 2.10.7, and 2.10.14(a), shall apply only when other than dry gas is distributed and climatic conditions make such provisions necessary.

### 2.10.1. Building Structure:

The building structure shall not be weakened by the installation of any gas piping. Before any beams or joists are cut or notched, special permission should be obtained from the authority having jurisdiction.

### 2.10.2 Gas Piping to be Graded:

All gas piping shall be graded not less than ¼ inch in 15 feet to prevent traps. All horizontal lines shall grade to risers and from the risers to the meter, or to service regulator when a meter is not provided, or to the appliance.

### 2.10.3 Piping Supports:

(a) Gas piping in buildings shall be supported with pipe hooks, metal pipe straps, bands or hangers suitable for the size of piping, and of adequate strength and quality, and located at proper intervals so that the piping cannot be moved accidentally from the installed position. Gas piping shall not be supported by other piping.

(b) Spacing of supports in gas piping installations shall not be greater than shown in Table 2.

**Table 2**
**Support of Piping**

| Size of Pipe (Inches) | (Feet) | Size of Tubing (Inch O.D.) | (Feet) |
|---|---|---|---|
| ½ | 6 | ½ | 4 |
| ¾ or 1 | 8 | ⅝ or ¾ | 6 |
| 1¼ or larger (horizontal) | 10 | ⅞ or 1 | 8 |
| 1¼ or larger (vertical) | every floor level | | |

### 2.10.4 Protect against Freezing:

Gas piping shall be protected against freezing temperatures. When piping must be exposed to wide ranges or sudden changes in temperatures, special care shall be taken to prevent stoppages.

### 2.10.5 Overhanging Rooms:

When there are overhanging kitchens or other rooms built beyond foundation walls, in which gas appliances are installed, care shall be taken to avoid placing the gas piping where it will be exposed to low temperatures (40° F or below for manufactured gas) or to extreme changes of temperatures. In such cases the gas piping shall be brought up inside the building proper and run around the sides of the room, in the most practical manner.

### 2.10.6 Gas Pipe Turns:

Changes in direction of gas pipe may be made by the use of fittings, factory bends, or field bends. Field bends shall be made under the following limitations:

(a) *Metallic Pipe*

1. Bends shall be made only with bending equipment and procedures especially intended for that purpose.
2. All bends shall be smooth and free from buckling, cracks or other evidence of mechanical damage.
3. The longitudinal weld of the pipe shall be near the neutral axis of the bend.
4. Pipe shall not be bent through an arc of more than 90 degrees.
5. The inside radius of a bend shall be not less than six (6) times the outside diameter of the pipe.

(b) *Plastic Pipe*

1. Plastic pipe may be bent provided that the pipe is not damaged and the internal diameter of the pipe is not effectively reduced.
2. The radius of the inner curve of such bends shall not be less than 25 times the inside diameter of the pipe.
3. If the piping manufacturer specifies the use of special bending equipment or procedures, such equipment or procedures shall be used.

### 2.10.7 Provide Drips Where Necessary:

A drip shall be provided at any point in the line of pipe where condensate may collect. When condensation is excessive, a drip should be provided at the outlet of the meter. This drip should be so installed as to constitute a trap wherein an accumulation of condensate will shut off the flow of gas before it will run back into the meter.

### 2.10.8 Location and Size of Drips:

All drips shall be installed only in such locations that they will be readily accessible to permit cleaning or emptying. A drip shall not be located where the condensate is likely to freeze. The size of any drip used shall be determined by the capacity and the exposure of the gas piping which drains to it and in accordance with recommendations of the serving gas supplier.

### 2.10.9 Use Tee:

If dirt or other foreign material is a problem, a tee fitting with the bottom outlet plugged or capped shall be used at the bottom of any pipe riser (see Figure 1).

### 2.10.10 Avoid Clothes Chutes, etc.:

Gas piping inside any building shall not be run in or through an air duct, clothes chute, chimney or gas vent, ventilating duct, dumb waiter, or elevator shaft.

### 2.10.11 Cap All Outlets:

(a) Each outlet, including a valve or cock outlet, shall be securely closed gastight with a threaded plug or cap immediately after installation and shall be left closed until an appliance is connected thereto. Likewise, when an appliance is disconnected from an outlet and the outlet is not to be used again immediately, it shall be securely closed gastight. The outlet shall not be closed with tin caps, wooden plugs, corks, or by other improvised methods.

(b) The above provision does not prohibit the normal use of a listed quick-disconnect device.

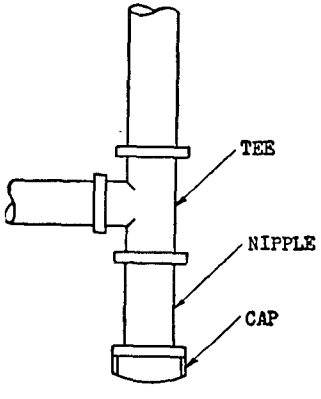



**Fig. 1. Suggested Method of Installing Tee.**

### 2.10.12 Outlets:

(a) The outlet fittings or piping shall be securely fastened in place.

(b) Outlets shall not be located behind doors.

(c) Outlets shall be located far enough from floors, walls, patios, slabs, and ceilings to permit the use of proper wrenches with-

out straining, bending or damaging the piping.

(d) The unthreaded portion of gas piping outlets shall extend not less than one inch through finished ceilings, or indoor or outdoor walls.

(e) The unthreaded portion of gas piping outlets shall extend not less than two inches above the surface of floors or outdoor patios or slabs.

(f) The provisions of 2.10.12(d) and 2.10.12(e) do not apply to listed quick-disconnect devices of the flush-mounted type. Such devices shall be installed in accordance with the manufacturer's installation instructions.

### 2.10.13 Prohibited Devices:

No device shall be placed inside the gas piping or fittings that will reduce the cross-sectional area or otherwise obstruct the free flow of gas.

### 2.10.14 Branch Pipe Connection:

(a) All branch outlet pipes shall be taken from the top or sides of horizontal lines and not from the bottom.

(b) When a branch outlet is placed on a main supply line before it is known what size of pipe will be connected to it, the outlet shall be of the same size as the line which supplies it.

### 2.10.15 Electrical Bonding and Grounding:

(a) A gas piping system within a building shall be electrically continuous and bonded to any grounding electrode, as defined by the National Electrical Code, USAS C1-1968 (NFPA No. 70-1968).*

(b) Underground gas service piping shall not be used as a grounding electrode except when it is electrically continuous uncoated metallic piping, and its use as a grounding electrode is acceptable both to the serving gas supplier and to the authority having jurisdiction, since gas piping systems are often constructed with insulating bushings or joints, or are of coated or nonmetallic piping.

## 2.11 *GAS SHUTOFF VALVES*

### 2.11.1 Accessibility of Gas Valves:

Main gas shutoff valves controlling several gas piping systems

*Available from the National Fire Protection Association, 60 Batterymarch St., Boston, Mass. 02110 in pamphlet form and in the National Fire Codes, Volume 5. Also available from the United States of America Standards Institute, 10 East 40th St., New York, N. Y. 10016.

shall be placed an adequate distance from each other so they will be easily accessible for operation and shall be installed so as to be protected from physical damage. It is recommended that they be plainly marked with a metal tag attached by the installing agency so that the gas piping systems supplied through them can be readily identified. It is advisable to place a shutoff valve at every point where safety, convenience of operation, and maintenance demands.

### 2.11.2 Shutoff Valves for Multiple House Lines:

(a) In multiple tenant buildings supplied through a master meter or one service regulator when a meter is not provided, or where meters or service regulators are not readily accessible from the appliance location, an individual shutoff valve for each apartment, or for each separate house line, shall be provided at a convenient point of general accessibility.

(b) In a common system serving a number of individual buildings, shutoff valves shall be installed at each building.

## 2.12 *TEST OF PIPING FOR TIGHTNESS*

Before any system of gas piping is finally put in service, it shall be carefully tested to assure that it is gastight. Where any part of the system is to be enclosed or concealed, this test should precede the work of closing in. To test for tightness, the piping may be filled with the fuel gas, air or inert gas, but not with any other gas or liquid. OXYGEN SHALL NEVER BE USED.

(a) Before appliances are connected, piping systems shall stand a pressure of at least six inches mercury or three pounds gage for a period of not less than ten minutes without showing any drop in pressure. Pressure shall be measured with a mercury manometer or slope gage, or an equivalent device so calibrated as to be read in increments of not greater than one-tenth pound. The source of pressure shall be isolated before the pressure tests are made.

(b) Systems for undiluted liquefied petroleum gases shall stand the pressure test in accordance with 2.12(a), or, when appliances are connected to the piping system, shall stand a pressure of not less than 10 inches nor more than 14 inches water column (8 ounces per square inch) for a period of not less than 10 minutes without showing any drop in pressure. Pressure shall be measured with a water manometer or an equivalent device calibrated so as to be read in increments of not greater than one-tenth inch water column. The source of pressure shall be isolated before the pressure tests are made.

## 2.13 *LEAKAGE CHECK AFTER GAS TURN ON*

### 2.13.1 Close All Gas Outlets:

Before turning gas under pressure into any piping, all openings from which gas can escape shall be closed.

### 2.13.2 Check for Leakage:

Immediately after turning on the gas, the piping system shall be checked by one of the following methods to ascertain that no gas is escaping:

(a) Checking for Leakage Using the Gas Meter

Immediately prior to the test it should be determined that the meter is in operating condition and has not been bypassed.

Checking for leakage can be done by carefully watching the test dial of the meter to determine whether gas is passing through the meter. To assist in observing any movement of the test hand, wet a small piece of paper and paste its edge directly over the center line of the hand as soon as the gas is turned on. Allow five minutes for a one-half foot dial and proportionately longer for a larger dial in checking for gas flow. This observation should be made with the test hand on the upstroke.

In case careful observation of the test hand for a sufficient length of time reveals no movement, the piping shall be purged and a small gas burner turned on and lighted and the hand of the test dial again observed. If the dial hand moves (as it should), it will show that the meter is operating properly. If the test hand does not move or register flow of gas through the meter to the small burner, the meter is defective and the gas should be shut off and the serving gas supplier notified.

(b) Checking for Leakage Not Using a Meter

This can be done by attaching to an appliance orifice a manometer or equivalent device calibrated so that it can be read in increments of 0.1 inch water column, and momentarily turning on the gas supply and observing the gaging device for pressure drop with the gas supply shut off. No discernible drop in pressure shall occur during a period of 3 minutes.

(c) When Leakage is Indicated

If the meter test hand moves, or a pressure drop on the gage is noted, all appliances or outlets supplied through the system shall be examined to see if they are shut off and do not leak. If they are found tight there is a leak in the piping system. The gas supply shall be shut off until the necessary repairs have been made, after which the test specified in 2.13.2(a) or (b) shall be repeated.

## 2.14 *PURGING*

### 2.14.1 Purging All Gas Piping:

(a) After piping has been checked, all gas piping shall be fully purged. A suggested method for purging the gas piping to an appliance is to disconnect the pilot piping at the outlet of the pilot valve. Piping shall not be purged into the combustion chamber of an appliance.

(b) The open end of piping systems being purged shall not discharge into confined spaces or areas where there are sources of ignition unless precautions are taken to perform this operation in a safe manner by ventilation of the space, control of purging rate, and elimination of all hazardous conditions.

### 2.14.2 Light Pilots:

After the gas piping has been sufficiently purged, all appliances shall be purged and the pilots lighted. The installing agency shall assure itself that all piping and appliances are fully purged before leaving the premises.

# Part 3 — Appliance Installation

## 3.1 *GENERAL*

### 3.1.1 Appliances, Accessories and Equipment to be "Approved."

Gas appliances, accessories, and equipment shall be "Approved." "Approved" shall mean "acceptable to the authority having jurisdiction."

NOTE: In determining acceptability, the authority having jurisdiction may base acceptance on compliance with NFPA, USA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure or use. The authority having jurisdiction may also refer to the listings or labeling (see Part 7, Definitions) practices of nationally recognized testing laboratories,* i.e., laboratories qualified and equipped to conduct the necessary tests, in a position to determine compliance with appropriate standards for the current production of listed items, and the satisfactory performance of such equipment or materials in actual usage.

### 3.1.2 Type of Gas:

It shall be determined whether the appliance has been designed for use with the gas to which it will be connected. No attempt shall be made to convert the appliance from the gas specified on the rating plate for use with a different gas without consulting the serving gas supplier or the appliance manufacturer for complete instructions.

### 3.1.3 Safety Shutoff Devices for Unlisted LP-Gas Appliances Used Indoors:

Safety shutoff devices of the complete shutoff type shall be installed on manually controlled water heaters and automatically controlled appliances, except domestic ranges and commercial cooking equipment having pilot input ratings of 500 Btu per hour or less, for use with undiluted liquefied petroleum gases.

### 3.1.4 Use of Air or Oxygen under Pressure:

When air or oxygen under pressure is used in connection with the gas supply, effective means such as a back pressure regulator

*Among the laboratories nationally recognized by the authorities having jurisdiction in the United States and Canada from whom listings are available are the Underwriters' Laboratories, Inc., the Factory Mutual Engineering Corporation, the American Gas Association, Inc., Laboratories, the Underwriters' Laboratories of Canada, the Canadian Standards Association Testing Laboratories, and the Canadian Gas Association Approvals Division.

The National Fire Protection Association and the United States of America Standards Institute do not approve, inspect or certify any installations, procedures, equipment or materials, nor do they approve or evaluate testing laboratories.

and relief valve shall be provided to prevent air or oxygen from passing back into the gas piping. The serving gas supplier shall be consulted for details. When oxygen is used, see the Standard for Installation and Operation of Oxygen-Fuel Gas Systems for Welding and Cutting, NFPA No. 51-1969.*

### 3.1.5 Flammable Vapors:

Gas appliances shall not be installed in any location where flammable vapors are likely to be present, unless the design, operation and installation are such as to eliminate the possible ignition of the flammable vapors.

### 3.1.6 Installation in Residential Garages:

(a) Gas appliances may be installed on the floor of a residential garage provided a door of the garage opens to an adjacent ground or driveway level that is at or below the level of the garage floor. When this condition does not exist, appliances shall be installed so that the burners and pilots are at least 18 inches above the floor.

(b) Gas appliances shall be located, or reasonably protected, so that they are not subject to physical damage by a moving vehicle.

### 3.1.7 Installation in Commercial Garages:

(a) Floor mounted heaters in commercial garages for more than 3 motor vehicles shall be installed as follows:

1. Heaters may be located in a room separated from other parts of the garage by construction having at least a one hour fire-resistance rating. This room shall not be used for combustible storage and shall have no direct access from the garage storage or repair areas. All air for combustion purposes entering such a room shall be from outside of the building, or
2. Floor mounted heaters may be located in the garage if they are installed so that the bottom of the combusion chamber is at least 18 inches above the floor and outside grade level. Such heaters shall be protected from physical damage by vehicles.

(b) Overhead heaters shall be installed at least 8 feet above the floor.

(c) Sealed combustion system heaters may be located within a garage. When necessary, they shall be protected against physical damage.

### 3.1.8 Installation in Aircraft Hangars:

Heaters in aircraft hangars shall be installed in accordance with NFPA No. 409-1969, Standard on Aircraft Hangars.*

*Available from the National Fire Protection Association, 60 Batterymarch Street, Boston, Mass. 02110.

### 3.1.9 Venting of Flue Gases:

Appliances shall be vented in accordance with the provisions of Part 5, Venting of Appliances.

### 3.1.10 Extra Device or Attachment:

No device or attachment shall be installed on any appliance which may in any way impair the combustion of gas.

### 3.1.11 Adequate Capacity of Piping:

When connecting additional appliances to a gas piping system, the existing piping shall be checked to determine if it has adequate capacity (see 2.4). If inadequate, the existing system shall be enlarged as necessary or separate gas piping of adequate capacity shall be run from the meter or from the service regulator when a meter is not provided, to the appliance.

### 3.1.12 Avoid Strain on Gas Piping:

Gas appliances shall be adequately supported and so connected to the piping as not to exert undue strain on the connections.

### 3.1.13 Venting of Gas Appliance Pressure Regulators:

(a) Gas appliance pressure regulators requiring access to the atmosphere for successful operation shall be equipped with vent piping leading to the outdoors, or into the combustion chamber adjacent to a constantly burning pilot, unless constructed or equipped with a vent limiting means to limit the escape of gas from the vent opening in the event of diaphragm failure.

(b) Vent limiting means on gas appliance pressure regulators, when tested at the inlet pressure indicated, shall limit the escape of gas to not more than that specified in Table 3.

**Table 3**

| Gas Pressure Regulator | Test Inlet Pressure, inches w.c. | Max. Gas Flow Rate, CFH | |
|---|---|---|---|
| | | Nat., Mfd., Mixed, LP Gas-Air | Undiluted L.P. Gases |
| Listed Class I | 10.5 | 2.5 | 1.0 |
| Listed Class II | 21.0 | 2.5 | 1.0 |
| Unlisted | 21.0 | 2.5 | 1.0 |

(c) In the case of vents leading to the outdoors, means shall be employed to prevent water from entering this piping and also to prevent stoppage of it by insects and foreign matter.

(d) In the case of vents entering the combustion chamber, the vent shall be located so that the escaping gas will be readily ignited from the pilot flame and the heat liberated will not adversely affect the operation of the thermal element of the safety shutoff device. The terminus of the vent shall be securely held in a fixed position relative to the pilot flame. For manufactured gas, a flame arrester in the vent piping may also be necessary.

### 3.1.14 Combination of Appliances:

Any combination of appliances, attachments, or devices used together in any manner shall comply with the standards which apply to the individual appliances.

### 3.1.15 Installation Instructions:

The installing agency shall conform with the appliance manufacturer's specific recommendations in completing an installation that will provide satisfactory performance and serviceability. The installing agency shall also leave the manufacturer's installation, operating and maintenance instructions in a location on the premises where they will be readily available for reference and guidance of the authority having jurisdiction, servicemen and the owner or operator.

### 3.1.16 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 and be accessible for service. (See 3.3.1.)

## 3.2 *DRAFT HOODS*

### 3.2.1 When Required:

(a) Every vented appliance, except incinerators, dual oven type combination ranges, sealed combustion system appliances and units designed for power burners or for forced venting, shall be installed with a draft hood. The draft hood supplied with or forming a part of listed vented appliances shall be installed without

*Continued on page 54-33*

*Available from the National Fire Protection Association, 60 Batterymarch Street, Boston, Mass. 02110.

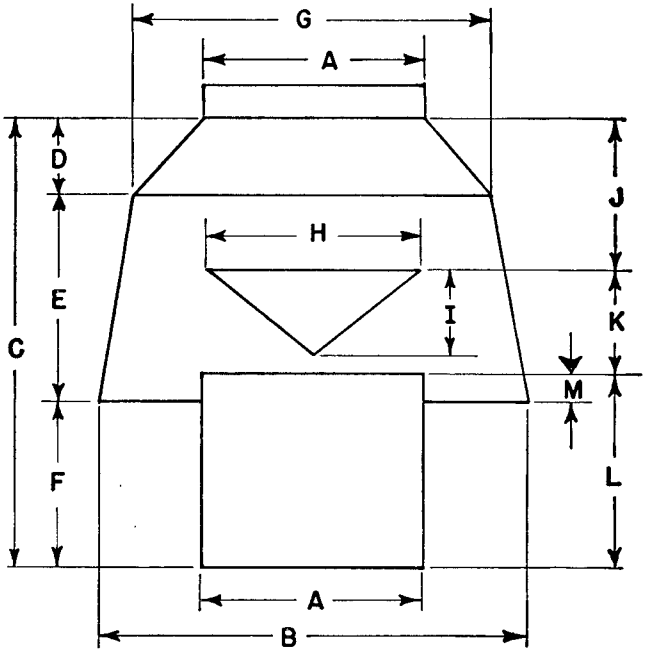



**Table of Dimensions**
**(inches)**

| A | B | C | D | E | F | G | H | I | J | K | L | M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 5.5 | 7.0 | 0.7 | 3.8 | 2.5 | 4.4 | 3.0 | 1.5 | 2.3 | 1.5 | 3.2 | 0.7 |
| 4 | 7.2 | 9.5 | 1.0 | 5.0 | 3.5 | 6.0 | 4.0 | 2.0 | 3.0 | 2.0 | 4.5 | 1.0 |
| 5 | 9.4 | 10.8 | 1.5 | 5.3 | 4.0 | 8.0 | 5.0 | 2.3 | 3.5 | 2.4 | 4.9 | 0.9 |
| 6 | 11.5 | 12.0 | 1.9 | 5.6 | 4.5 | 9.8 | 6.0 | 2.5 | 4.0 | 2.7 | 5.3 | 0.8 |
| 7 | 13.5 | 13.9 | 2.3 | 6.4 | 5.3 | 11.6 | 7.0 | 2.9 | 4.6 | 3.1 | 6.2 | 0.9 |
| 8 | 15.5 | 15.8 | 2.7 | 7.1 | 6.0 | 13.4 | 8.0 | 3.2 | 5.3 | 3.5 | 7.0 | 1.0 |
| 9 | 17.5 | 17.5 | 3.1 | 7.7 | 6.7 | 15.2 | 9.0 | 3.5 | 5.8 | 4.0 | 7.7 | 1.0 |
| 10 | 19.7 | 18.8 | 3.6 | 7.9 | 7.3 | 17.2 | 10.0 | 3.8 | 6.2 | 4.3 | 8.3 | 1.0 |
| 11 | 22.2 | 20.7 | 4.3 | 8.4 | 8.0 | 19.6 | 11.0 | 4.1 | 6.6 | 4.6 | 9.5 | 1.5 |
| 12 | 24.7 | 22.2 | 5.0 | 8.7 | 8.5 | 22.0 | 12.0 | 4.4 | 7.0 | 5.0 | 10.2 | 1.7 |

**NOTE: This is only one design of a vertical hood and should not be construed as the only design that may be used. A hood of any other design which will meet the USA Standard Listing Requirements for Draft Hoods, Z21.12-1937 should be satisfactory within the limits of performance specified.**

**Fig. 2. Suggested General Dimensions for a Vertical Draft Hood**

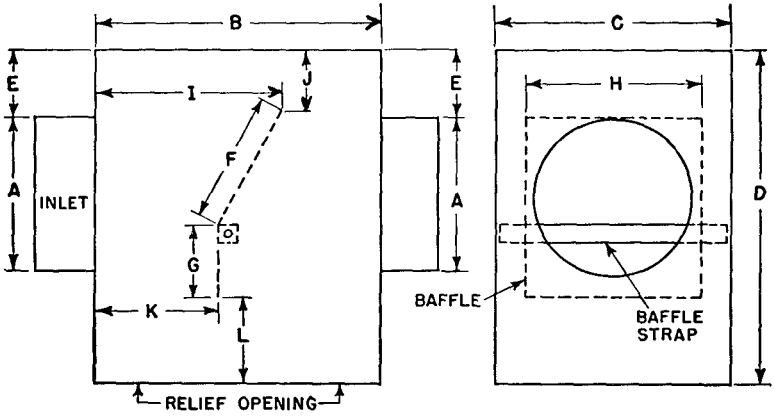



**Table of Dimensions**
(inches)

| A | B | C | D | E | F | G | H | I | J | K | L |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 6 | 5 | 9 7/8 | 1 1/2 | 2 1/2 | 1 9/16 | 3 1/2 | 3 3/4 | 1 3/8 | 2 1/2 | 4 3/4 |
| 4 | 8 | 6 3/4 | 11 5/8 | 2 | 3 3/8 | 2 1/8 | 4 5/8 | 5 | 1 7/8 | 3 3/8 | 4 3/4 |
| 5 | 10 | 8 3/8 | 13 1/4 | 2 1/2 | 4 3/16 | 2 9/16 | 5 7/8 | 6 1/4 | 2 3/8 | 4 3/16 | 4 3/4 |
| 6 | 12 | 10 | 15 | 3 | 5 | 3 1/8 | 7 | 7 1/2 | 2 7/8 | 5 | 4 3/4 |
| 7 | 14 | 11 3/4 | 16 3/4 | 3 1/2 | 5 7/8 | 3 11/16 | 8 1/8 | 8 3/4 | 3 3/8 | 5 7/8 | 4 3/4 |
| 8 | 16 | 13 3/8 | 18 3/8 | 4 | 6 11/16 | 4 1/8 | 9 3/8 | 10 | 3 7/8 | 6 11/16 | 4 3/4 |
| 9 | 18 | 15 | 20 1/8 | 4 1/2 | 7 1/2 | 4 11/16 | 10 1/2 | 11 1/4 | 4 3/8 | 7 1/2 | 4 3/4 |
| 10 | 20 | 16 3/4 | 21 3/4 | 5 | 8 3/8 | 5 1/8 | 11 5/8 | 12 1/2 | 4 7/8 | 8 3/8 | 4 3/4 |
| 11 | 22 | 18 3/8 | 23 1/2 | 5 1/2 | 9 3/16 | 5 11/16 | 12 3/4 | 13 3/4 | 5 3/8 | 9 3/16 | 4 3/4 |
| 12 | 24 | 20 | 25 1/4 | 6 | 10 | 6 1/4 | 14 | 15 | 5 7/8 | 10 | 4 3/4 |

**NOTE: This is only one design for a horizontal hood and should not be construed as the only design that may be used. A hood of any other design which will meet the USA Standard Listing Requirements for Draft Hoods, Z21.12-1937 should be satisfactory within the limits of performance specified.**

**Fig. 3. Suggested General Dimensions for a Horizontal Draft Hood**

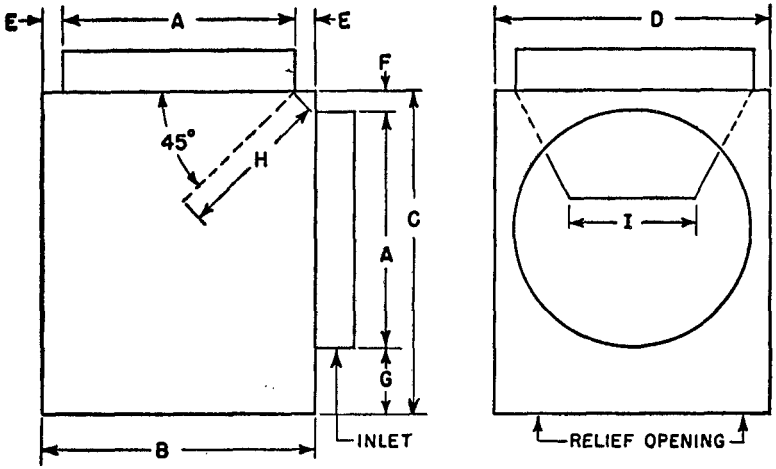



**Table of Dimensions**
(inches)

| A | B | C | D | E | F | G | H | I |
|---|---|---|---|---|---|---|---|---|
| 3 | 4 | 4 1/4 | 4 | 1/2 | 1/2 | 3/4 | 2 | 1 1/4 |
| 4 | 5 | 5 1/2 | 5 | 1/2 | 1/2 | 1 | 2 11/16 | 1 5/8 |
| 5 | 6 | 6 3/4 | 6 | 1/2 | 1/2 | 1 1/4 | 3 5/16 | 2 |
| 6 | 7 | 8 | 7 | 1/2 | 1/2 | 1 3/4 | 4 | 2 3/8 |
| 7 | 8 | 9 1/4 | 8 | 1/2 | 1/2 | 1 3/4 | 4 11/16 | 2 3/4 |
| 8 | 9 | 10 1/2 | 9 | 1/2 | 1/2 | 2 | 5 5/16 | 3 1/8 |
| 9 | 10 | 11 3/4 | 10 | 1/2 | 1/2 | 2 1/4 | 6 | 3 1/2 |
| 10 | 11 | 13 | 11 | 1/2 | 1/2 | 2 1/2 | 6 11/16 | 3 7/8 |
| 11 | 12 | 14 1/4 | 12 | 1/2 | 1/2 | 2 3/4 | 7 5/16 | 4 1/4 |
| 12 | 13 | 15 1/2 | 13 | 1/2 | 1/2 | 3 | 8 | 4 5/8 |

**NOTE: This is only one design of a horizontal to vertical hood and should not be construed as the only design that may be used. A hood of any other design which will meet the USA Standard Listing Requirements for Draft Hoods, Z21.12-1937, should be satisfactory within the limits of performance specified.**

**Fig. 4. Suggested General Dimensions for a Horizontal to Vertical Draft Hood**

alteration, exactly as furnished and specified by the appliance manufacturer. If a draft hood is not supplied by the appliance manufacturer when one is required, it shall be supplied by the installing agency and be of a listed or approved type, and in the absence of other instructions shall be the same size as the appliance flue collar. When a draft hood is required with a conversion burner, it shall be of a listed or approved type supplied by the installing agency or as recommended by the manufacturer.

(b) When the installer determines that a draft hood of special design is needed or preferable for a particular installation, advice of the manufacturer, the serving gas supplier or authority having jurisdiction shall be secured. (For suggested general dimensions of draft hood, see Figures 2, 3 and 4.)

### 3.2.2 Installation:

The draft hood shall be in the same room as the combustion air opening of the appliance. In no case shall a draft hood be installed in a false ceiling, in a different room, or in any manner that will permit a difference in pressure between the draft hood relief opening and the combustion air supply. The draft hood supplied for gas conversion burners shall be so located that the burner is capable of safe and efficient operation.

### 3.2.3 Positioning:

A draft hood shall be installed in the position for which it was designed with reference to the horizontal and vertical planes and shall be located so that the relief opening is not obstructed by any part of the appliance or adjacent construction. The appliance and its draft hood shall be located so that the relief opening is accessible for checking vent operation.

### 3.2.4 Clearance:

A draft hood shall be located so that the draft hood relief opening is not less than six inches from any surface except that of the appliance it serves and the venting system to which the draft hood is connected. When a greater or lesser clearance is indicated on the appliance label, the clearance shall not be less than that specified on the label. These clearances shall not be reduced.

## 3.3 *ACCESSIBILITY AND CLEARANCE*

### 3.3.1 Accessibility for Service:

(a) Every gas appliance shall be located with respect to building construction and other equipment so as to permit access to the

appliance. Sufficient clearance shall be maintained to permit cleaning of heating surfaces; the replacement of filters, blowers, motors, burners, controls and vent connections; the lubrication of moving parts where necessary; and the adjustment and cleaning of burners and pilots. For attic installation the passageway and servicing area adjacent to the appliance shall be floored.

(b) Appliances listed for outdoor installation may be installed without protection in accordance with the provisions of their listing and shall be accessible for servicing.

### 3.3.2 Clearance to Combustible Materials:

(a) Gas appliances and their vent connectors shall be installed with clearances from combustible material so that their operation will not create a hazard to persons or property.

(b) Minimum clearances between combustible walls and the back and sides of various conventional types of appliances and their vent connectors are specified in Parts 4 and 5.

## 3.4 *AIR FOR COMBUSTION AND VENTILATION*

### 3.4.1 General:

(a) The provisions of 3.4 apply to appliances installed in buildings and which require air for combustion, ventilation, and dilution of flue gases from within the building. They do not apply to (1) sealed combustion system appliances which are constructed and installed so that all air for combustion is obtained from the outside atmosphere and all flue gases are discharged to the outside atmosphere, or (2) enclosed furnaces which incorporate an integral total enclosure and use only outside air for combustion and dilution of flue gases.

(b) Appliances shall be installed in a location in which the facilities for ventilation permit satisfactory combustion of gas, proper venting and the maintenance of ambient temperature at safe limits under normal conditions of use. Appliances shall be located so as not to interfere with proper circulation of air within the confined space. When buildings are so tight that normal infiltration does not provide the necessary air, outside air shall be introduced.

(c) While all forms of building construction cannot be covered in detail, air for combustion, ventilation and dilution of flue gases for gas appliances vented by natural draft normally may be obtained by application of one of the methods covered in 3.4.2, 3.4.3 and 3.4.6.

### 3.4.2 Appliances Located in Unconfined Spaces:

(a) In unconfined spaces in buildings of conventional frame, masonry, or metal construction, infiltration normally is adequate to provide air for combustion, ventilation, and dilution of flue gases.

(b) If the unconfined space is within a building of unusually tight construction, air for combustion, ventilation, and dilution of flue gases shall be obtained from outdoors or from spaces freely communicating with the outdoors. A permanent opening or openings having a total free area of not less than one square inch per 5,000 Btu per hour of total input rating of all appliances shall be provided. Ducts may be used to convey make-up air from the outdoors and shall be of the same cross-sectional area as the free area of the openings to which they connect. The ducts may be connected to the cold air return of the heating system only if they connect directly to outside air. The minimum dimension of rectangular air ducts shall be not less than 3 inches.

### 3.4.3 Appliances Located in Confined Spaces:

(a) *All Air From Inside Buildings:*

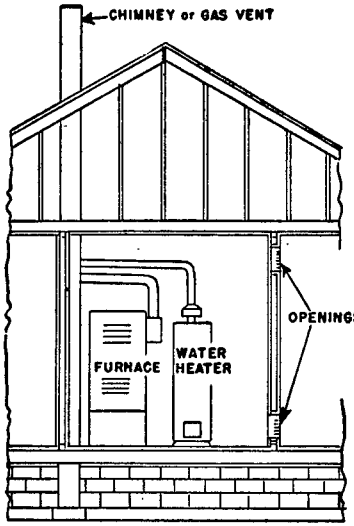
The confined space shall be provided with two permanent openings, one commencing within 12 inches of the top and one commencing within 12 inches of the bottom of the enclosure. Each opening shall have a minimum free area of one square inch per 1,000 Btu per hour of the total input rating of all appliances in the enclosure. The openings must freely communicate with interior areas having in turn adequate infiltration from the outside. (See Figure 5.)

(b) *All Air From Outdoors:*

The confined space shall be provided with two permanent openings, one commencing within 12 inches of the top and one commencing within 12 inches of the bottom of the enclosure. The openings shall communicate directly, or by ducts, with outdoors or spaces (crawl or attic) that freely communicate with outdoors.

1. When directly communicating with the outdoors each opening shall have a minimum free area of one square inch per 4,000 Btu per hour of total input rating of all appliances in the enclosure. (See Figure 6.)

2. When communicating with the outdoors through vertical ducts each opening shall have a minimum free area of one square inch per 4,000 Btu per hour of total input rating of all appliances in the enclosure. (See Figure 7.)




***Note: Each opening shall have a free area of not less than one square inch per 1,000 Btu per hour of the total input rating of all appliances in the enclosure.***

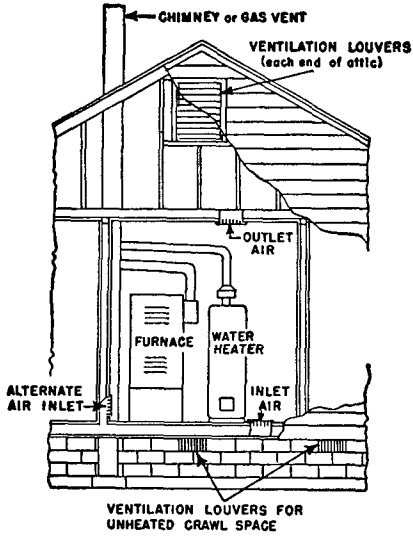
**Fig. 5. Appliances Located in Confined Spaces All Air from Inside the Building. See 3.4.3 (a).**

3. When communicating with the outdoors through horizontal ducts each opening shall have a minimum free area of one square inch per 2,000 Btu per hour of total input rating of all appliances in the enclosure. (See Figure 8.)

4. When ducts are used, they shall be of the same cross-sectional area as the free area of the openings to which they connect. The minimum dimension of rectangular air ducts shall be not less than 3 inches.

(c) *Ventilation Air From Inside Buildings—Combustion and Draft Hood Dilution Air From Outdoors:*

The confined space shall be provided with two openings located and sized as in 3.4.3(a). In addition there shall be one opening directly communicating with outdoors or spaces (crawl or attic) that freely communicate with outdoors. This opening shall have a minimum free area of one square inch per 5,000 Btu per hour of total input of all appliances in the enclosure. Ducts may be used to convey make-up air and shall be of the same cross-sectional area as the free area of the openings to which they connect. The ducts may be connected to the cold air return of the heating system only if they connect directly to outside air. The minimum dimension of rectangular air ducts shall not be less than 3 inches. (See Figure 9.)




***NOTE:***

***The inlet and outlet air openings shall each have a free area of not less than one square inch per 4,000 Btu per hour of the total input rating of all appliances in the enclosure.***

Fig. 6. Appliances Located in Confined Spaces All Air from Outdoors — Inlet Air from Ventilated Crawl Space and Outlet Air to Ventilated Attic. See 3.4.3 (b).

***NOTE:***

***The inlet and outlet air openings shall each have a free area of not less than one square inch per 4,000 Btu per hour of the total input rating of all appliances in the enclosure.***

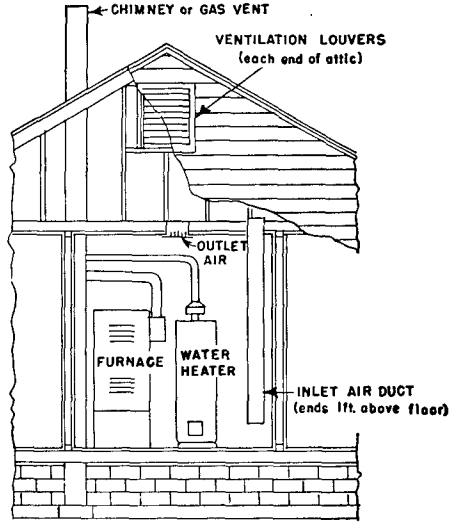
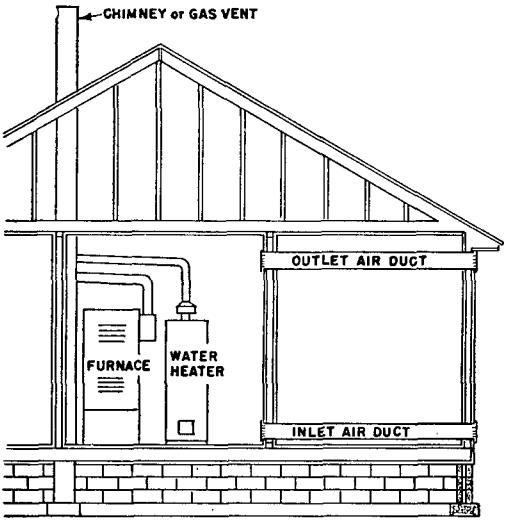



Fig. 7. Appliances Located in Confined Spaces All Air from Outdoors Through Ventilated Attic. See 3.4.3 (b).




***NOTE: Each air duct opening shall have a free area of not less than one square inch per 2,000 Btu per hour of the total input rating of all appliances in the enclosure.****

***If the appliance room is located against an outside wall and the air openings communicate directly with the outdoors, each opening shall have a free area of not less than one square inch per 4,000 Btu per hour of the total input rating of all appliances in the enclosure.***

**Fig. 8. Appliances Located in Confined Spaces All Air from Outdoors. See 3.4.3 (b).**

### 3.4.4 Louvers and Grilles:

In calculating free area in 3.4.2 and 3.4.3, consideration shall be given to the blocking effect of louvers, grilles or screens protecting openings. Screens used shall not be smaller than ¼ inch mesh. If the free area through a design of louver or grille is known, it should be used in calculating the size opening required to provide the free area specified. If the design and free area is not known, it may be assumed that wood louvers will have 20-25 per cent free area and metal louvers and grilles will have 60-75 per cent free area.

### 3.4.5 Special Conditions Created by Mechanical Exhausting or Fireplaces:

Operation of exhaust fans, kitchen ventilation systems, clothes dryers, or fireplaces may create conditions requiring special attention to avoid unsatisfactory operation of installed gas appliances.

### 3.4.6 Specially Engineered Installations:

The size of combustion air openings specified in 3.4.2 and 3.4.3 shall not necessarily govern when special engineering provides an adequate supply of air for combustion, ventilation, and dilution of flue gases.

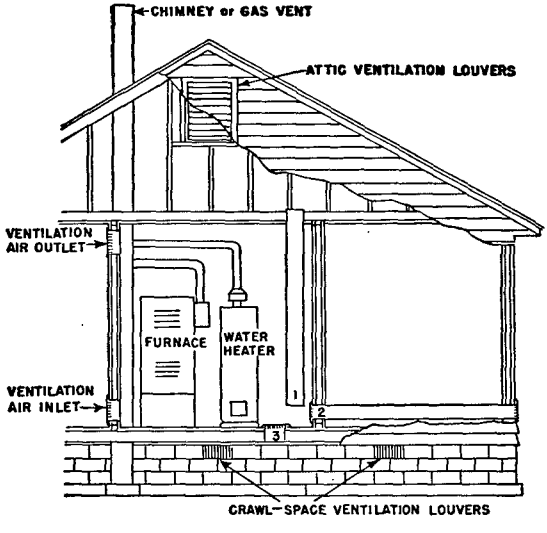
## 3.5 *APPLIANCES ON ROOFS*

### 3.5.1 General:

(a) Appliances shall be designed or enclosed so as to withstand climatic conditions in the area in which they are installed. If enclosures are provided, each enclosure shall permit easy entry and movement, shall be of reasonable height, and shall have at least 2 feet clearance to either side of the service access panel(s) of the appliance(s) in the enclosure.

(b) Roofs on which appliances are to be installed shall be capable of supporting the additional load or shall be reinforced to support the additional load.

(c) All access locks, screws and bolts shall be of corrosion-resistant material.




**NOTE: Ducts used for make-up air may be connected to the cold air return of the heating system only if they connect directly to outdoor air.**

**Attic Ventilation Louvers are required at each end of attic with alternate air inlet No. 1.**

**1, 2, and 3 mark alternate locations for air from outdoors. Free area shall be not less than 1 square inch per 5,000 Btu per hour of the total input rating of all appliances in the enclosure.**

**Crawl - Space Ventilation Louvers for unheated crawl space are required with alternate air inlet No. 3.**

**Each Ventilation Air Opening from inside the building shall have a free area of not less than 1 square inch per 1,000 Btu per hour of the total input rating of all appliances in the enclosure.**

**Fig. 9. Appliances Located in Confined Spaces. Ventilation Air From Inside Building — Combustion and Draft Hood Dilution Air from Outside, Ventilated Attic or Ventilated Crawl Space. See 3.4.3 (c).**

### 3.5.2. Installation:

(a) Appliances shall be installed in accordance with their listing and the manufacturer's installation instructions.

(b) Appliances shall be installed on a well-drained surface. At least 6 feet clearance shall be available between the appliance and the edge of a roof or similar hazard, or rigidly fixed rails or guards at least 3 feet in height shall be provided on the exposed side except that parapets or other building structure at least 3 feet in height may be utilized in lieu of rails or guards.

(c) Each appliance requiring an external source of electrical power for its operation shall be provided with an accessible electrical disconnect means near the appliance.

(d) When water stands on the roof at the appliance or in the passageways to the appliance, or when the roof is of a design having a water seal, a suitable platform or walkway, or both shall be provided above the water line. Such platform(s) or walkway(s) shall be located adjacent to the appliance and control panels so that the appliance can be safely serviced when water stands on the roof.

### 3.5.3 Access to Appliances:

(a) Appliances located on roofs or other elevated locations shall be accessible.

(b) Buildings of more than one story in height shall have an inside means of access to the roof.

(c) The inside means of access shall be a permanent, or foldaway, inside stairway or ladder, terminating in an enclosure, scuttle or trap door. Such scuttles or trap doors shall be at least 24 inches by 24 inches in size, and shall open easily and safely under all conditions, especially snow, and shall be constructed so as to permit access from the roof side unless deliberately locked on the inside.

At least 6 feet clearance shall be available between the access opening and the edge of the roof or similar hazard, or rigidly fixed rails or guards at least 3 feet in height shall be provided on the exposed side except that parapets or other building structure at least 3 feet in height may be utilized in lieu of guards or rails.

(d) Proper permanent lighting shall be provided at the roof access. The switch for such lighting shall be located inside the building near the access means leading to the roof.

### 3.5.4 Additional Provisions:

Also see provisions of 3.1.16, 3.3.1 and 5.9.3.

## 3.6 *APPLIANCE CONNECTIONS TO BUILDING PIPING*

### 3.6.1 Connecting Gas Appliances:

Gas appliances shall be connected by:

(a) Rigid pipe, or

(b) Semi-rigid tubing extensions of a tubing piping system, or,

(c) Listed appliance connectors that are in the same room as the appliance, or,

(d) Semi-rigid tubing in lengths up to 6 feet that are in the same room as the appliance. When acceptable to the serving gas supplier greater lengths may be used and need not be connected to an outlet in the same room as the appliance.

The connector or tubing shall be installed so as to be protected against physical damage.

Aluminum alloy tubing and connectors shall be factory coated to protect against external corrosion where they are in contact with masonry, plaster, or insulation or are subject to repeated wettings by such liquids as water (except rainwater), detergents or sewage. Aluminum alloy tubing shall not be used in exterior locations.

(e) Listed gas hose connectors in accordance with 3.6.2.

### 3.6.2 Use of Gas Hose Connectors:

Listed gas hose connectors shall be used as follows:

(a) *Indoor:*

Indoor gas hose connectors may be used with laboratory, shop or ironing equipment that requires mobility during operation. A shutoff valve shall be installed where the connector is attached to the building piping. The connector shall be of minimum length but shall not exceed 6 feet. The connector shall not be concealed and shall not extend from one room to another nor pass through wall partitions, ceilings or floors.

(b) *Outdoor:*

Outdoor gas hose connectors may be used to connect portable outdoor gas-fired appliances. A shutoff valve or a listed quick-disconnect device shall be installed where the connector is attached to the supply piping and in such a manner to prevent the accumulation of water or foreign matter. This connection shall only be made in the outdoor area where the appliance is to be used.

### 3.6.3 Appliance Shutoff Valves:

Any appliance connected to a piping system shall have an ac-

cessible manual shutoff valve installed upstream of the union or connector and within 6 feet of the appliance it serves.

### 3.6.4 Quick-Disconnect Devices:

Appliance connectors may be connected to the building piping by means of a listed quick-disconnect device and, when installed indoors, a manual shutoff valve shall be installed upstream of the quick-disconnect device.

## 3.7 *ELECTRICAL CONNECTIONS*

### 3.7.1 Electrical Connections:

Electrical connections between gas appliances and the building wiring shall conform to the National Electrical Code, USAS C1-1968 (NFPA No. 70-1968) *

### 3.7.2 Electric Ignition and Control Devices:

No devices employing or depending upon an electrical current shall be used to control or ignite a gas supply if of such a character that failure of the electrical current could result in the escape of unburned gas or in failure to reduce the supply of gas under conditions which would normally result in its reduction unless other means are provided to prevent the development of dangerous temperatures, pressures or the escape of gas.

### 3.7.3 Electrical Circuit:

The electrical circuit employed for operating the automatic main gas-control valve, automatic pilot, room temperature thermostat, limit control or other electrical devices used with the gas appliance shall be in accordance with the wiring diagrams supplied with the appliance.

### 3.7.4 Continuous Power:

All gas appliances using electrical controls shall have the controls connected into a permanently live electric circuit, i.e., one that is not controlled by a light switch. Central heating gas appliances should be provided with a separate electrical circuit.

---

*Available from the National Fire Protection Association, 60 Batterymarch St., Boston, Mass. 02110 in pamphlet form and in the National Fire Codes, Volume 5. Also available from the United States of America Standards Institute, 10 East 40th St., New York, N. Y. 10016.

### 3.7.5 Transformers:

It is recommended that any separately mounted transformer necessary for the operation of the gas appliance be mounted on a junction box, and a switch with "On" and "Off" markings installed in the hot wire side of the transformer primary.

### 3.7.6 Wire Size:

It is recommended that multiple conductor cable, not lighter than No. 18 American Wire Gage, having type "T" (formerly type SN) insulation or equivalent be used on control circuits. Multiple conductor cables should be color coded to assist in correct wiring and to aid in tracing low-voltage circuits.

## 3.8 *ROOM TEMPERATURE THERMOSTATS*

### 3.8.1 Locations:

Room temperature thermostats should be located in the natural circulating path of room air. The device should not be placed so that it is exposed to cold air infiltration, drafts from outside openings such as windows and doors, air current from warm or cold air registers, or so that the natural circulation of the air is cut off such as behind doors, in shelves, or in corners.

Thermostats controlling floor furnaces shall not be located in a room or space which can be separated from the room or space in which the register of the floor furnace is located.

### 3.8.2 Exposure:

A room temperature thermostat should not be exposed to heat from nearby radiators, fireplaces, radios, television sets, lamps, rays of the sun, or mounted on a wall containing pipes or warm air ducts, or a chimney or gas vent, which would affect its operation and prevent it from properly controlling the room temperature.

### 3.8.3 Drafts:

Any hole in the plaster or panel through which the wires pass from the thermostat to the appliance being controlled shall be adequately sealed with suitable material to prevent drafts from affecting the thermostat.

# Part 4 — Installation of Specific Appliances

## 4.1 *GENERAL*

A listed appliance or accessory may be installed in accordance with its listing, or as elsewhere specified in Part 4.

## 4.2 *DOMESTIC RANGES*

### 4.2.1 Clearance from Combustible Material:

(a) Listed domestic ranges (except as noted in 4.2.1(b) and 4.2.1(c)) when installed on combustible floors shall be set on their own bases or legs and shall be installed in accordance with their listing and the manufacturer's instructions. In the absence of clearance information, the range shall be installed with clearances of not less than that shown in Table 4. The clearance shall not interfere with combustion air, accessibility for operation and servicing.

(b) Listed domestic ranges with listed gas room heater sections shall be installed so that the warm air discharge side shall have a minimum clearance of 18 inches between it and adjacent combustible material. A minimum clearance of 36 inches shall be provided between the top of the heater section and the bottom of cabinets. The minimum clearance between the back of the heater section and combustible material shall be in accordance with Table 6, Minimum Clearances for Listed Room Heaters.

**Table 4**

**Minimum Clearances for Listed Domestic Ranges, Unless Otherwise Marked**

| Type of Range | Spacing of Center Line of Top Burners From Side of Range | Distance from Combustible Material-Inches | | | |
|---|---|---|---|---|---|
| | | Sides | | Rear | |
| | | Wall Not Extending Above Cooking Top | Wall Extending Above Cooking Top | Body of Range | Projecting Flue Box |
| Insulated | Less than 10 in. | 1/2 | 4 1/2 | 1 | 1 |
| Insulated | 10 in. or more | 1/2 | 1/2 | 1 | 1 |
| Flush to Wall | Less than 10 in. | Flush | 4 1/2 | Flush | — |
| Flush to Wall | 10 in. or more | Flush | Flush | Flush | — |

(c) Domestic ranges which include a solid or liquid fuel burning section shall be spaced from combustible material and otherwise installed in accordance with the standards applying to the supplementary fuel section of the range.

(d) Unlisted domestic ranges shall be installed with at least a 6-inch clearance at the back and sides to combustible material. Combustible floors under unlisted appliances shall be protected in an approved manner.*

### 4.2.2 Vertical Clearance Above Cooking Top:

Domestic ranges shall have a vertical clearance above the cooking top of not less than 30 inches to combustible material or metal cabinets except the clearance may be reduced to not less than 24 inches as follows:

(a) The underside of the combustible material or metal cabinet above the cooking top is protected with asbestos millboard at least ¼-inch thick covered with sheet metal not lighter than No. 28 manufacturer's standard gage, or,

(b) A metal ventilating hood of not lighter than No. 28 manufacturer's standard gage sheet metal is installed above the cooking top with a clearance of not less than ¼ inch between the hood and the underside of the combustible material or metal cabinet and the hood is at least as wide as the range is and is centered over the range.

### 4.2.3 Install Level:

Ranges shall be installed so that the cooking top or oven racks are level.

## 4.3 *BUILT-IN DOMESTIC COOKING UNITS*

### 4.3.1 Installation:

Listed built-in domestic cooking units shall be installed in accordance with their listing and the manufacturer's instructions. Listed built-in domestic cooking units may be installed in combustible material unless otherwise marked.

The installation shall not interfere with combustion air, accessibility for operation and servicing.

Unlisted built-in domestic cooking units shall not be installed in, or adjacent to, combustible material.

*For details of protection, refer to the Code for the Installation of Heat-Producing Appliances, available from the American Insurance Association, 85 John St., New York, New York 10038.

#### 4.3.2 Vertical Clearance Above Top Cooking Unit:

Built-in domestic top (or surface) cooking units shall have a vertical clearance above the cooking top of not less than 30 inches to combustible material or metal cabinets except the clearance may be reduced to not less than 24 inches as follows:

(a) The underside of the combustible material or metal cabinet above the cooking top is protected with asbestos millboard at least ¼-inch thick covered with sheet metal not lighter than No. 28 manufacturer's standard gage, or:

(b) A metal ventilating hood of not lighter than No. 28 manufacturer's standard gage sheet metal is installed above the cooking top with a clearance of not less than ¼ inch between the hood and the underside of the combustible material or metal cabinet and the hood is at least as wide as the unit is and is centered over the unit.

#### 4.3.3 Horizontal Clearance of Listed Top Cooking Units from Walls Extending above Top Panel:

The minimum horizontal distance from the center of the burner head(s) of a top (or surface) cooking unit to vertical combustible walls extending above the top panel shall be not less than that distance specified by the permanent marking on the unit.

#### 4.3.4 Install Level:

Built-in cooking units shall be installed so that the cooking top, broiler pan, or oven racks are level.

### 4.4 *OPEN TOP BROILER UNITS*

#### 4.4.1 Listed Units:

Listed open top broiler units shall be installed in accordance with their listing and the manufacturer's instructions.

#### 4.4.2 Unlisted Units:

Unlisted open top broiler units shall be installed in accordance with the manufacturer's instructions, but shall not be installed in combustible material.

#### 4.4.3 Protection Above Domestic Units:

Domestic open top broiler units shall be provided with a metal ventilating hood of not lighter than No. 28 manufacturer's standard gage with a clearance of not less than ¼ inch between the hood and the underside of combustible material or metal cabinets. A minimum clearance of 24 inches shall be maintained between the cooking top and the combustible material or metal cabinet and the hood shall be at least as wide as the open top broiler unit is and be centered over the unit.

### 4.4.4 Commercial Units:

Commercial open top broiler units shall be provided with ventilation in accordance with "Vapor Removal from Commercial Cooking Equipment," NFPA No. 96-1969.*

## 4.5 *WATER HEATERS*

### 4.5.1 Prohibited Installations:

Water heaters, with the exception of those having sealed combustion systems, shall not be installed in bathrooms, bedrooms, or any occupied rooms normally kept closed.

Single-faucet automatic instantaneous water heaters, as permitted under 5.1.2, in addition to the above, shall not be installed in kitchen sections of light housekeeping rooms or rooms used by transients.

### 4.5.2 Location:

Water heaters shall be located as close as practicable to the chimney or gas vent. They should be located so as to provide short runs of piping to fixtures.

### 4.5.3 Clearance:

(a) Listed water heaters shall be installed in accordance with their listing and the manufacturer's instructions. In no case shall the clearances be such as to interfere with combustion air, draft hood clearance and relief, and accessibility for servicing. (See Table 5.)

**Table 5**

**Minimum Clearances for Listed Water Heaters**

| Type of Heater | Distance from Combustible Material Inches | |
|---|---|---|
| | Nearest Part of Jacket | Flat Side |
| Type A | 6 | . . . . |
| Type B | 2 | . . . . |
| Type C | . . . . | Flush |
| Counter Type Unit | In accordance with manufacturer's instructions. | |

Type A—Miscellaneous (including circulating tank, instantaneous).

Type B—Underfired, insulated automatic storage heaters.

Type C—Type B units with one or more flat sides and listed for installation flush to wall.

Counter Type—Type B units specifically designed for installation in or beneath a counter.

*Available from the National Fire Protection Association, 60 Batterymarch Street, Boston, Mass., 02110.

(b) Unlisted water heaters shall be installed with a clearance of 12 inches on all sides and rear. Combustible floors under unlisted water heaters shall be protected in an approved manner.*

### 4.5.4 Connections:

Water heaters shall be connected in a manner to permit observation, maintenance, and servicing.

### 4.5.5 Pressure Limiting Devices:

A water heater installation shall be provided with overpressure protection by means of an approved device.

### 4.5.6 Temperature Limiting Devices:

An automatic storage type water heater installation or a hot water storage vessel installation shall be provided with overtemperature protection by means of an approved device.

### 4.5.7 Temperature, Pressure and Vacuum Relief Valves:

The installation and adjustment of temperature, pressure, and vacuum relief valves or combinations thereof, and automatic gas shutoff valves or devices shall be in accordance with the requirements of the authority having jurisdiction, or, with the manufacturer's instructions accompanying such devices.

### 4.5.8 Automatic Instantaneous Type:

(a) *Cold Water Supply*: The water supply to any automatic instantaneous water heater shall be such as to provide sufficient pressure to properly operate the water actuated control valve, when drawing hot water from a faucet on the top floor.

### 4.5.9 Circulating or Tank Types:

(a) *Connection Boiler or Tank:* The method of connecting the circulating water heater to the tank shall provide proper circulation of water through the heater, and permit a safe and useful temperature of water to be drawn from the tank (see Figure 10).

(b) *Size of Water Circulating Piping*: The size of the water circulating piping, in general, shall conform with the size of the water connections of the heater.

*For details of protection refer to the Code for the Installation of Heat Producing Appliances, available from the American Insurance Association, 85 John Street, New York, N. Y. 10038.

(c) *Sediment Drain*: A suitable water valve or cock, through which sediment may be drawn off or the tank emptied, shall be installed at the bottom of the tank.

(d) *Anti-Siphoning Devices*: Means acceptable to the authority having jurisdiction shall be provided to prevent siphoning in any boiler or tank to which any circulating water heater is attached. A cold water tube with a hole near the top is commonly accepted for this purpose (see Figure 10).

## 4.6 *ROOM HEATERS*

### 4.6.1 Installations in Sleeping Quarters:

Room heaters installed in sleeping quarters for use of transients, as in hotels and motels, shall be vented by one of the methods described in Part 5, Venting Of Appliances (see 5.2.2), and equipped with a safety shutoff device. It is recommended that room heaters installed in all sleeping quarters or rooms generally kept closed be similarly vented and equipped with a safety shutoff device.

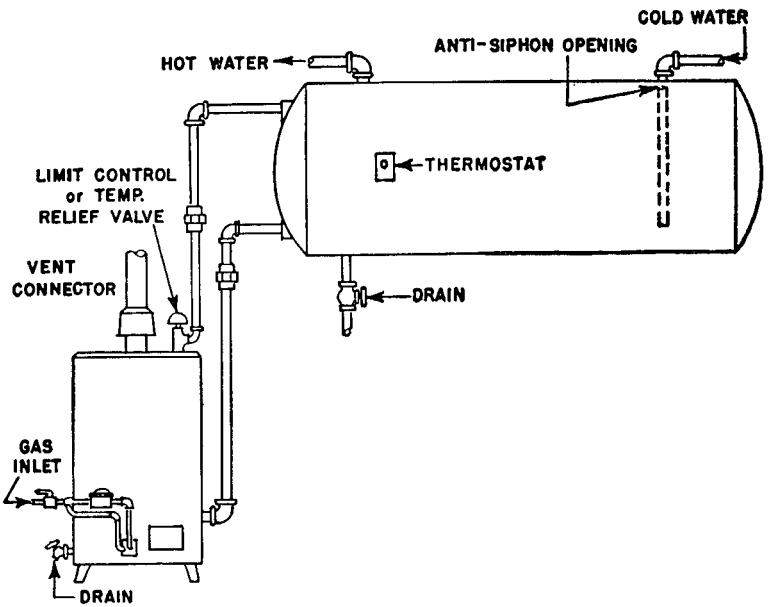



**Fig 10. Suggested Location for Anti-Siphon Opening in Cold Water Inlet**

### 4.6.2 Installations in Institutions:

Room heaters installed at any location in institutions such as Homes for the Aged, Sanitariums, Convalescent Homes, Orphanages, etc., shall be of the vented type and shall be connected to an effective chimney or gas vent and equipped with an automatic pilot.

### 4.6.3 Clearance:

A room heater shall be placed so as not to cause a hazard to walls, floors, curtains, furniture, doors when open, etc., and to the free movements of persons within the room. Appliances designed and marked "For use in noncombustible fire-resistive fireplace only," shall not be installed elsewhere. Listed room heaters shall be installed with clearances not less than specified in Table 10, except that appliances listed for installation at lesser clearances may be installed in accordance with their listings. In no case shall the clearances be such as to interfere with the requirements of combustion air and accessibility. (See 3.3.1 and 3.4.)

Unlisted room heaters shall be installed with clearances from combustible material not less than the following:

(a) *Circulating Type.* Room heaters having an outer jacket surrounding the combustion chamber, arranged with openings at top and bottom so that air circulates between the inner and outer jacket, and without openings in the outer jacket to permit direct radiation, shall have clearance at sides and rear of not less than 12 inches.

(b) *Radiating Type.* Room heaters other than those described above as of circulating type shall have clearance at sides and rear of not less than 18 inches; except that heaters which make use of metal, asbestos or ceramic material to direct radiation to the front of the appliance shall have a clearance of 36 inches in front, and if constructed with a double back of metal or ceramic may be installed with a clearance of 18 inches at sides and 12 inches at rear.

**Table 6**

**Minimum Clearances for Listed Room Heaters**

| Types of Appliance | Distance from Combustible Material, Inches | |
|---|---|---|
| | Jacket, Sides and Rear | Projecting Flue Box or Draft Hood |
| Warm Air Circulators | 6 | 2 |
| Radiant Heaters | 6 | 2 |
| Wall Heaters | Flush | .... |

Combustible floors under unlisted room heaters shall be protected in an approved manner.*

#### 4.6.4 Wall Type Room Heaters:

Wall type room heaters shall not be installed in or attached to walls of combustible material unless listed for such installation.

#### 4.6.5 Connection:

The provisions of 3.6, Appliance Connections to Building Piping, shall be observed.

### 4.7 *CENTRAL HEATING BOILERS AND FURNACES*

#### 4.7.1 Manual Main Shutoff Valves:

When a complete shutoff type safety shutoff device is not utilized, a manual main shutoff valve shall be provided ahead of all controls except the manual pilot gas valve.

When a complete shutoff type safety shutoff device is utilized, a manual main shutoff valve shall be provided ahead of all controls.

#### 4.7.2 Clearance:

(a) Central heating boilers and furnaces installed in rooms which are large in comparison with the size of the appliance, shall be installed with clearances not less than specified in Table 7 except as provided in 4.7.2(a) 1 and 2.

1. Central heating furnaces and boilers listed for installation at lesser clearances than specified in Table 7 may be installed in accordance with their listing and the manufacturer's instructions.
2. Central heating furnaces and boilers installed in unconfined spaces may be installed with reduced clearances to combustible material provided the combustible material or the appliance is protected as described in Table 8.

(b) Central heating furnaces and boilers installed in confined spaces shall be installed in accordance with their listing and, when such units are installed in spaces such as alcoves and closets, they shall be specifically listed for such installation. The installation clearances for furnaces and boilers in confined spaces shall not be reduced by the protection methods described in Table 8.

*For details of protection refer to the Code for the Installation of Heat Producing Appliances, available from the American Insurance Association, 85 John Street, New York, N. Y. 10038.

**Table 7**

**Clearances To Combustible Material For Furnaces And Boilers Installed In Rooms Which Are Large In Comparison With Size Of Appliance, Except As Provided In 4.7.2 (a) (See Note 9)**

| | Minimum Clearance, Inches | | | | |
|---|---|---|---|---|---|
| | Above and Sides of Bonnet or Plenum | Jacket Sides and Rear | Front (See Note 1) | Projecting Flue Box or Draft Hood | Vent Connector (See Note 2) |
| I. Listed automatically fired, forced air or gravity system, with 250 F temperature limit control. | 2 (See Notes 3 and 4) | 6 | 18 | 6 | 6 |
| II. Unlisted automatically fired, forced air or gravity system, equipped with temperature limit control which cannot be set higher than 250 F. | 6 (See Note 5) | 6 | 18 | 18 (See Note 6) | 18 (See Note 6) |
| III. Listed Automatically Fired Heating Boilers — Steam boilers operating at not over 15 psi gage pressure and hot water boilers operating at not in excess of 250 F. | 6 (See Note 7) | 6 | 18 | 6 | 6 |
| IV. Unlisted Automatically Fired Heating Boilers — Steam boilers operating at not over 15 psi gage pressure and hot water boilers operating at not in excess of 250 F. | 6 (See Note 7) | 6 | 18 | 18 (See Note 6) | 18 (See Note 6) |
| V. Central heating boilers and furnaces, other than above. | 18 (See Note 8) | 18 | 18 | 18 (See Note 6) | 18 (See Note 6) |

## NOTES APPLICABLE TO TABLE 7

1. Front clearance shall be sufficient for servicing the burner and furnace or boiler.

2. The vent connector clearance does not apply to listed Type B gas vents.

3. This clearance may be reduced to 1 inch for a listed forced air or gravity furnace equipped with:

   a. A limit control that cannot be set higher than 200 F, or

   b. A marking to indicate that the outlet air temperature cannot exceed 200 F.

4. Clearance from supply ducts within 3 feet of the plenum shall not be less than that specified from the bonnet or plenum. No clearance is required beyond this distance.

5. Clearance from supply ducts within 6 feet of the plenum shall not be less than 6 inches. No clearance is required beyond this distance.

6. For unlisted gas appliances equipped with an approved draft hood, this clearance may be reduced to 9 inches.

7. This clearance is above top of boiler.

8. Clearance from supply ducts shall not be less than 18 inches out to 3 feet from the bonnet or plenum, not less than 6 inches from 3 feet to 6 feet, and not less than 1 inch beyond 6 feet.

9. Rooms which are large in comparison with the size of the appliance are rooms having a volume equal to at least 12 times the total volume of a furnace and at least 16 times the total volume of a boiler. Total volume of furnace or boiler is determined from exterior dimensions and is to include fan compartments and burner vestibules, when used. When the actual ceiling height of a room is greater than 8 feet, the volume of a room shall be figured on the basis of a ceiling height of 8 feet.

## Table 8

### Clearances, Inches, with Specified Forms of Protection*

| Type of Protection Applied to the combustible material unless otherwise specified and covering all surfaces within the distance specified as the required clearance with no protection. (See Fig. 11). Thicknesses are minimum. | Where the required Clearance with no protection is: | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 36 inches | | | 18 inches | | | 12 inches | | 9 inches | 6 inches | | |
| | Above | Sides & Rear | Vent Connector | Above | Sides & Rear | Vent Connector | Above | Sides & Rear | Vent Connector | Above | Sides & Rear | Vent Connector |
| (a) 1/4 in. asbestos millboard spaced out 1"† | 30 | 18 | 30 | 15 | 9 | 12 | 9 | 6 | 6 | 3 | 2 | 3 |
| (b) 28 gage sheet metal on 1/4" asbestos millboard | 24 | 18 | 24 | 12 | 9 | 12 | 9 | 6 | 4 | 3 | 2 | 2 |
| (c) 28 gage sheet metal spaced out 1"† | 18 | 12 | 18 | 9 | 6 | 9 | 6 | 4 | 4 | 2 | 2 | 2 |
| (d) 28 gage sheet metal on 1/8" asbestos millboard spaced out 1"† | 18 | 12 | 18 | 9 | 6 | 9 | 6 | 4 | 4 | 2 | 2 | 2 |
| (e) 1 1/2" asbestos cement covering on heating appliance | 18 | 12 | 36 | 9 | 6 | 18 | 6 | 4 | 9 | 2 | 1 | 6 |
| (f) 1/4" asbestos millboard on 1" mineral wool bats reinforced with wire mesh or equivalent | 18 | 12 | 18 | 6 | 6 | 6 | 4 | 4 | 4 | 2 | 2 | 2 |
| (g) 22 gage sheet metal on 1" mineral wool bats reinforced with wire or equivalent | 18 | 12 | 12 | 4 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 |
| (h) 1/4" asbestos cement board or 1/4" asbestos millboard | 36 | 36 | 36 | 18 | 18 | 18 | 12 | 12 | 9 | 4 | 4 | 4 |
| (i) 1/4" cellular asbestos | 36 | 36 | 36 | 18 | 18 | 18 | 12 | 12 | 9 | 3 | 3 | 3 |

*Except for the protection described in (e), all clearances shall be measured from the outer surface of the appliance to the combustible material disregarding any intervening protection applied to the combustible material.
†Spacers shall be of noncombustible material.

(c) When the plenum is adjacent to plaster on metal lath or noncombustible material attached to combustible material, the clearance shall be measured to the surface of the plaster or other noncombustible finish when the clearance specified is 2 inches or less.

(d) The clearance to these appliances shall not interfere with combustion air, draft hood clearance and relief, and accessibility for servicing. (See 3.2.4, 3.3.1 and 3.4.)

### 4.7.3 Erection and Mounting:

A central heating boiler or furnace shall be erected in accordance with the manufacturer's instructions and shall be installed on a floor of fire-resistive construction with noncombustible flooring and surface finish and with no combustible material against the underside thereof or on fire-resistive slabs or arches having no combustible material against the underside thereof unless listed for installation on a combustible floor, or the floor is protected in an approved manner.*

### 4.7.4 Connection of Flow and Return Piping:

The method of connecting the flow and return piping on steam and hot water boilers shall be in accordance with the manufacturer's recommendations to facilitate a positive, balanced and unobstructed flow of water or steam through the boiler. The direction of flow through the boiler shall be established by use of normal return and flow connections.**

### 4.7.5 Feed Water and Drain Connections:

Steam and hot water boilers shall be provided with means of introducing feed or make-up water from a water supply through an individual control valve and connection to the boiler piping system. A drain valve shall also be provided and connected with the lowest water space practicable for the purpose of draining or flushing the boiler.

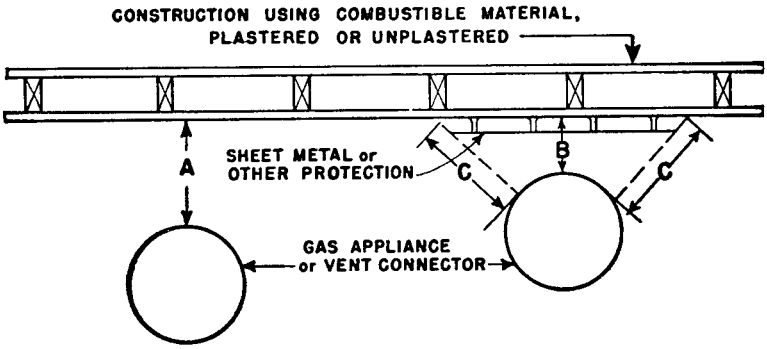
### 4.7.6 Temperature or Pressure Limiting Devices:

Steam and hot water boilers respectively shall be provided with approved automatic limiting devices for shutting down the burn-

---

*For details of protection refer to the Code for the Installation of Heat Producing Appliances, available from the American Insurance Association, 85 John St., New York, N .Y. 10038.

**For common piping systems reference may be made to the American Society of Heating, Refrigerating and Air Conditioning Engineers Guide, available from The American Society of Heating, Refrigerating and Air Conditioning Engineers, 62 Worth Street, New York, N. Y., 10013, and the I-B-R Guides available from The Hydronics Institute, 35 Russo Place, P.O. Box 262, Berkeley Heights, N.J. 07922.




**A equals the required clearance with no protection specified in Tables 7 and 10 and in the sections applying to various types of appliances.**

**B equals the reduced clearance permitted in accordance with Table 8. The protection applied to the construction using combustible material shall extend far enough in each direction to make C equal to A.**

**Fig. 11. Extent of Protection Necessary to Reduce Clearances From Gas Appliances or Vent Connectors.**

er(s) to prevent boiler steam pressure or boiler water temperature from exceeding the maximum allowable working pressure or temperature.

### 4.7.7 Low Water Cutoff:

Steam boilers shall be provided with an automatic means to shut off the fuel supply to the burner if the boiler water level drops to the lowest safe water line.

### 4.7.8 Steam Safety and Pressure Relief Valves:

Steam and hot water boilers shall be equipped respectively with listed steam safety or pressure relief valves of appropriate discharge capacity and conforming with ASME requirements.* Steam safety valves and pressure relief valves shall be set to discharge at a pressure not to exceed the maximum allowable working pressure of the boiler.

### 4.7.9 Plenum Chambers and Air Ducts:

(a) A plenum chamber supplied as a part of a furnace shall be installed in accordance with the manufacturer's instructions.

*For details of requirements on low pressure heating boiler safety devices refer to ASME Boiler and Pressure Vessel Code, Section IV, Heating Boilers, available from The American Society of Mechanical Engineers, United Engineering Center, 345 East 47th Street, New York, N. Y. 10017.

(b) When a plenum chamber is not supplied with the furnace, any fabrication and installation instruction provided by the manufacturer shall be followed. The method of connecting supply and return ducts shall facilitate proper circulation of air.*

(c) When a furnace is installed so that supply ducts carry air circulated by the furnace to areas outside the space containing the furnace, the return air shall also be handled by a duct(s) sealed to the furnace casing and terminating outside the space containing the furnace.

**4.7.10 Refrigeration Coils:**

(a) A refrigeration coil shall not be installed in conjunction with a forced air furnace when circulation of cooled air is provided by the furnace blower unless the blower has sufficient capacity to overcome the external static resistance imposed by the duct system and cooling coil at the air throughput necessary for heating or cooling, whichever is greater.

(b) Furnaces shall not be located upstream from cooling units unless the cooling unit is designed or equipped so as not to develop excessive temperature or pressure.

(c) Refrigeration coils shall be installed in parallel with or on the downstream side of central furnaces to avoid condensation in the heating element unless the furnace has been specifically listed for downstream installation. With a parallel flow arrangement, the dampers or other means used to control flow of air shall be sufficiently tight to prevent any circulation of cooled air through the furnace.

(d) Adequate means shall be provided for disposal of condensate and to prevent dripping of condensate on the heating element.

**4.7.11 Cooling Units Used with Heating Boilers:**

(a) Boilers, when used in conjunction with refrigeration systems, shall be installed so that the chilled medium is piped in parallel with the heating boiler with appropriate valves to prevent the chilled medium from entering the heating boiler.

(b) When hot water heating boilers are connected to heating coils located in air handling units where they may be exposed to refrigerated air circulation, such boiler piping systems shall be equipped with flow control valves or other automatic means to prevent gravity circulation of the boiler water during the cooling cycle.

*Reference may be made to the Standard for the Installation of Air Conditioning and Ventilating Systems, NFPA No. 90A, Standard for the Installation of Residence Type Warm Air Heating and Air Conditioning Systems, NFPA No. 90B, available from the National Fire Protection Association, 60 Batterymarch St., Boston, Mass. 02110.

## 4.8 *WALL FURNACES*

### 4.8.1 Installation:

(a) Listed wall furnaces shall be installed in accordance with their listing and the manufacturer's instructions. They may be installed in or attached to combustible material.

(b) Unlisted wall furnaces shall not be installed in or attached to combustible material.

(c) Vented wall furnaces connected to a Type BW gas vent system listed only for single story shall be installed only in single story buildings or the top story of multistory buildings. Vented wall furnaces connected to a Type BW gas vent system listed for installation in multistory buildings may be installed in single story or multistory buildings. Type BW gas vents shall be attached directly to a solid header plate which may be an integral part of the vented wall furnace, and which serves as a fire stop at that point. The stud space in which the vented wall furnace is installed shall be ventilated at the first ceiling level by installation of the ceiling plate spacers furnished with the gas vent. Fire stop spacers shall be installed at each subsequent ceiling or floor level penetrated by the vent. (See Figure 12 for Type BW gas vent installation.)

(d) Sealed combustion system wall furnaces shall be installed with the vent-air intake terminal in the outside atmosphere. The thickness of the walls on which the appliance is mounted shall be within the range of wall thickness marked on the appliance and covered in the manufacturer's installation instructions.

(e) Panels, grilles and access doors which must be removed for normal servicing operations shall not be attached to the building.

### 4.8.2 Location:

Wall furnaces shall be located so as not to cause a hazard to walls, floors, curtains, furniture, or doors. Wall furnaces installed between bathrooms and adjoining rooms shall not circulate air from bathrooms to other parts of the building.

### 4.8.3 Manual Main Shutoff Valve:

A manual main shutoff valve shall be installed ahead of all controls including the pilot gas valve.

### 4.8.4 Combustion and Circulating Air:

Adequate combustion and circulating air shall be provided (see 3.4).

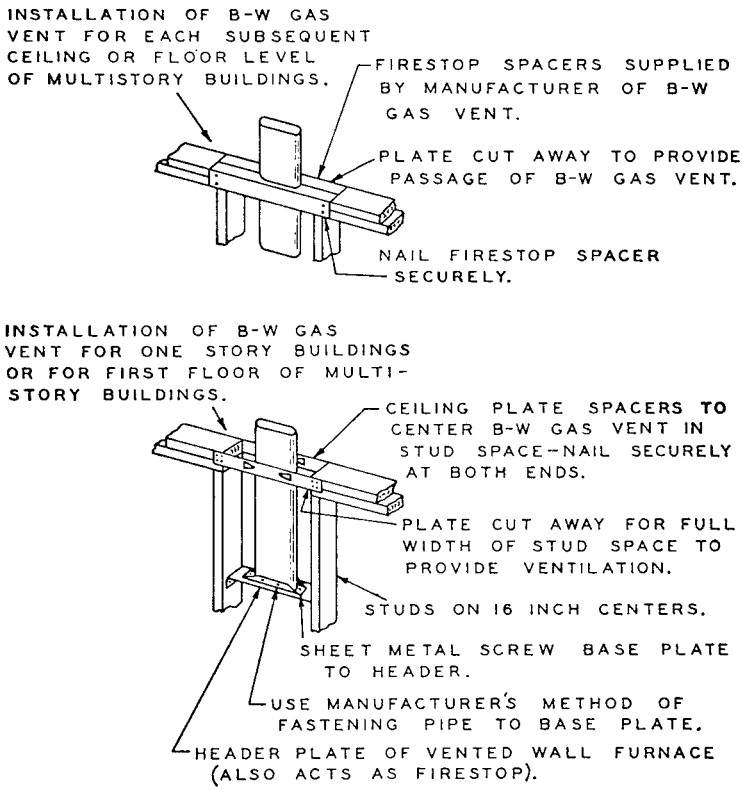



**Figure 12. Installation of Type B-W Gas Vents for Vented Wall Furnaces.**

## 4.9 *FLOOR FURNACES*

### 4.9.1. Installation:

(a) Listed floor furnaces shall be installed in accordance with their listing and the manufacturer's instructions. They may be installed in combustible floors.

(b) Unlisted floor furnaces shall not be installed in combustible floors.

### 4.9.2 Manual Main Shutoff Valve:

A separate manual main shutoff valve shall be provided ahead of all controls and a union connection shall be provided down-

stream from this valve to permit removal of the controls or the floor furnace.

**4.9.3 Temperature Limit Controls:**

(a) Listed automatically operated floor furnaces shall be equipped with a temperature limit control in accordance with the terms of their listing.

(b) Unlisted automatically operated floor furnaces shall be equipped with a temperature limit control arranged to shut off the flow of gas to the burner in the event the temperature at the warm air outlet grille exceeds 350° F above room temperature.

**4.9.4 Combustion and Circulating Air:**

Adequate combustion and circulating air shall be provided (see 3.4).

**4.9.5 Placement:**

The following provisions apply to furnaces to serve one story.

(a) Floor furnaces shall not be installed in the floor of any aisle or passageway of any auditorium, public hall, or place of assembly, or in an exitway from any such room or space.

(b) *Walls and Corners.* The grille of a floor furnace with a horizontal warm air outlet shall not be placed closer than 6 inches to the nearest wall. A distance of at least 15 inches from two adjoining sides of the floor grille to walls shall be provided to eliminate the necessity of occupants walking over the warm air discharge from grilles. Wall-register models shall not be placed closer than 6 inches to a corner.

(c) *Draperies.* The furnace shall be placed so that a door, drapery, or similar object cannot be nearer than 12 inches to any portion of the register of the furnace.

(d) *Central Location.* The furnace should be installed in a central location favoring slightly the sides exposed to the prevailing winter winds.

**4.9.6 Bracing:**

The space provided for the furnace shall be framed with doubled joists and with headers not lighter than the joists.

**4.9.7 Support:**

Means shall be provided to support the furnace when the floor grille is removed.

**4.9.8 Clearance:**

The lowest portion of the floor furnace shall have at least a

6-inch clearance from the general ground level, except that when the lower 6-inch portion of the floor furnace is sealed by the manufacturer to prevent entrance of water, the clearance may be reduced to not less than 2 inches. When these clearances are not present, the ground below and to the sides shall be excavated to form a "basin-like" pit under the furnace so that the required clearance is provided beneath the lowest portion of the furnace. A 12-inch clearance shall be provided on all sides except the control side, which shall have an 18-inch clearance.

**4.9.9 Access:**

The space in which any floor furnace is installed shall be accessible by an opening in the foundation not less than 24 by 18 inches or a trap door, not less than 24 by 24 inches in any cross section thereof, and a passageway not less than 24 by 18 inches in any cross section thereof. The serving gas supplier should be consulted with reference to the access facilities for servicing when it provides service.

**4.9.10 Seepage Pan:**

When the excavation exceeds 12 inches in depth or water seepage is likely to collect, a watertight copper pan, concrete pit, or other suitable material shall be used, unless adequate drainage is provided or the equipment is sealed by the manufacturer to meet this condition. A copper pan shall be made of not less than 16-ounce-per-square-foot sheet copper. The pan shall be anchored in place, so as to prevent floating, and the walls shall extend at least 4 inches above the ground level, with at least 6 inches clearance on all sides except the control side, which shall have at least 18 inches clearance.

**4.9.11 Wind Protection:**

Floor furnaces shall be protected, where necessary, against severe wind conditions.

**4.9.12 Upper Floor Installations:**

Listed floor furnaces may be installed in an upper floor provided the furnace assembly projects below into a utility room, closet, garage, or similar nonhabitable space. In such installations, the floor furnace shall be enclosed completely (entirely separated from the nonhabitable space) with means for air intake to meet the provisions of 3.4, with access for servicing, with minimum furnace clearances of 6 inches to all sides and bottom, and with the enclosure constructed of portland cement plaster on metal lath or material of equal fire resistance.

### 4.9.13 First Floor Installation:

Listed floor furnaces installed in the first or ground floors of buildings need not be enclosed unless the basements of these buildings have been converted to apartments or sleeping quarters, in which case the floor furnace shall be enclosed as specified for upper floor installations and shall project into a nonhabitable space.

## 4.10 *DUCT FURNACES*

### 4.10.1 Clearance:

(a) Listed duct furnaces shall be installed with clearances of at least 6 inches between adjacent walls, ceilings and floors of combustible material and the appliance projecting flue box or draft hood, except that duct furnaces listed for installation at lesser clearances may be installed in accordance with their listings. In no case shall the clearance be such as to interfere with combustion air and accessibility. (See 3.3.1 and 3.4.)

(b) Unlisted duct furnaces shall be installed with clearances to combustible materials in accordance with the clearances specified for unlisted furnaces and boilers in Table 7. Combustible floors under unlisted duct furnaces shall be protected in an approved manner.*

### 4.10.2 Erection of Appliance:

Duct furnaces shall be erected and firmly supported in accordance with the manufacturer's instructions.

### 4.10.3 Access Panels:

The ducts connected to duct furnaces shall have removable access panels on both the upstream and downstream sides of the furnace.

### 4.10.4 Location of Draft Hood and Controls:

The controls, combustion air inlet, and draft hoods for duct furnaces shall be located outside the ducts. The draft hood shall be located in the same enclosure from which combustion air is taken.

### 4.10.5 Circulating Air:

When a duct furnace is installed in a confined space, the air circulated by the furnace shall be handled by ducts which are sealed to the furnace casing and which separate the circulating air from the combustion and ventilation air.

*For details of protection refer to the Code for the Installation of Heat Producing Appliances, available from the American Insurance Association, 85 John St., New York, New York 10038.

**4.10.6 Duct Furnaces Used with Refrigeration Systems: —**

(a) A duct furnace shall not be installed in conjunction with a refrigeration coil when circulation of cooled air is provided by the blower unless the blower has sufficient capacity to overcome the external static resistance imposed by the duct system, furnace and the cooling coil at the air throughput necessary for heating or cooling, whichever is greater.

(b) To avoid condensation within heating elements, duct furnaces used in conjunction with cooling equipment shall be installed in parallel with or on the upstream side of cooling coils unless the duct furnace has been specifically listed for downstream installation. With a parallel flow arrangement, the dampers or other means used to control the flow of air shall be sufficiently tight to prevent any circulation of cooled air through the unit.

(c) When duct furnaces are to be located upstream from cooling units, the cooling unit shall be so designed or equipped as to not develop excessive temperatures or pressures.

(d) Duct furnaces may be installed downstream from evaporative coolers or air washers if the heating element is made of corrosion-resistant material. Stainless steel, ceramic-coated steel, or an aluminum-coated steel in which the bond between the steel and the aluminum is an iron-aluminum alloy, are considered to be corrosion-resistant. Air washers operating with chilled water which delivers air below the dew point of the ambient air at the appliance are considered as refrigeration systems.

**4.10.7 Installation in Commercial Garages and Aircraft Hangars:**

Duct furnaces installed in garages for more than three motor vehicles or in aircraft hangars shall be of a listed type and shall be installed in accordance with 3.1.7 and 3.1.8.

## 4.11 *CONVERSION BURNERS*

Installation of conversion burners shall conform to USA Standard Installation of Domestic Gas Conversion Burners, Z21.8-1965, and Addenda Z21.8a-1967,* except that an automatic means to shut off the fuel supply to the burner(s) shall be provided in accordance with 4.7.7.

## 4.12 *CONVERSION BURNERS FOR DOMESTIC RANGES*

Installation of conversion burners in ranges originally designed to utilize solid or liquid fuels shall conform to American Standard

*Available from the United States of America Standards Institute, 10 East 40th St., New York, New York 10016, or the American Gas Association, Inc., Laboratories, 1032 East 62nd St., Cleveland, Ohio 44103.

Requirements for Installation of Gas Conversion Burners in Domestic Ranges, Z21.38-1957.*

## 4.13 *UNIT HEATERS*

### 4.13.1 Support:

Suspended type unit heaters shall be safely and adequately supported with due consideration given to their weight and vibration characteristics. Hangers and brackets shall be of noncombustible material.

### 4.13.2 Manual Main Shutoff Valves:

When a complete shutoff type safety shutoff device is not utilized, a manual main shutoff valve shall be provided ahead of all controls except the manual pilot gas valve.

When a complete shutoff type safety shutoff device is utilized, a manual main shutoff valve shall be provided ahead of all controls.

A union connection shall be provided downstream from the manual main shutoff valve to permit removal of the controls.

### 4.13.3 Clearance:

(a) *Suspended Type Unit Heaters.*

1. Listed unit heaters shall be installed with clearance from combustible material of not less than 18 inches at the sides, 12 inches at the bottom and 6 inches above the top when the unit heater has an internal draft hood or 1 inch above the top of the sloping side of a vertical draft hood.
2. Unit heaters listed for reduced clearances shall be installed in accordance with their listing and the manufacturer's instructions.
3. Unlisted unit heaters shall be installed with clearance to combustible material of not less than 18 inches.
4. Additional clearances for servicing shall be in accordance with the manufacturer's recommendations contained in the installation instructions.

(b) *Floor-mounted Type Unit Heaters.*

1. Listed unit heaters shall be installed with clearance from combustible material at the back and one side only of not less than 6 inches. When the flue gases are vented horizontally, the 6 inch clearance shall be measured from the draft hood or vent instead of the rear wall of the unit heater.
2. Unit heaters listed for reduced clearances shall be installed in accordance with their listing and the manufacturer's instructions.

*Available from American Gas Association, Inc., 605 Third Ave., New York, N. Y. 10016.

3. Floor-mounted type unit heaters may be installed on combustible floors if listed for such installation.

4. Combustible floors under unlisted floor-mounted unit heaters shall be protected in an approved manner.*

5. Additional clearances for servicing shall be in accordance with the manufacturer's recommendations contained in the installation instructions.

#### 4.13.4 Combustion and Circulating Air:

Adequate combustion and circulating air shall be provided (see 3.4).

#### 4.13.5 Ductwork:

A unit heater shall not be attached to a warm air duct system unless listed and marked for such installation.

#### 4.13.6 Installation in Commercial Garages and Aircraft Hangars:

Unit heaters installed in garages for more than 3 motor vehicles or in aircraft hangars shall be of a listed type and shall be installed in accordance with 3.1.7 and 3.1.8.

### 4.14 *INFRARED RADIANT HEATERS*

#### 4.14.1 Support:

Suspended type infrared radiant heaters shall be safely and adequately fixed in position independent of gas and electric supply lines. Hangers and brackets shall be of noncombustible material.

#### 4.14.2 Clearance:

(a) Listed heaters shall be installed with clearances from combustible material in accordance with their listing and the manufacturer's instructions.

(b) Unlisted heaters shall be installed in accordance with clearances from combustible material acceptable to the authority having jurisdiction.

#### 4.14.3 Combustion and Ventilating Air:

(a) Where unvented infrared heaters are used, natural or mechanical means shall be provided to exhaust at least 4 cfm per 1,000 Btu per hour input of installed heaters.

*For details of protection refer to the Code for the Installation of Heat Producing Appliances, available from the American Insurance Association, 85 John St., New York, New York 10038.

(b) Exhaust openings for removing flue products shall be above the level of the heaters.

**4.14.4 Installation in Commercial Garages and Aircraft Hangars:**

Overhead heaters installed in garages for more than 3 motor vehicles or in aircraft hangars shall be of a listed type and shall be installed in accordance with 3.1.7 and 3.1.8.

## 4.15 *CLOTHES DRYERS*

**4.15.1 Clearance:**

(a) Listed Type 1 clothes dryers shall be installed with minimum clearance of 6 inches from adjacent combustible material except that clothes dryers listed for installation at lesser clearances may be installed in accordance with their listing.

(b) Listed Type 2 clothes dryers shall be installed with clearances of not less than shown on the marking plate and in the manufacturer's instructions. Type 2 clothes dryers designed and marked "For use only in fire-resistive locations" shall not be installed elsewhere.

(c) Unlisted clothes dryers shall be installed with clearances to combustible material of not less than 18 inches. Combustible floors under unlisted clothes dryers shall be protected in an approved manner.*

**4.15.2 Exhausting to the Outside Air:**

(a) Type 1 clothes dryers should not be installed in bathrooms or bedrooms unless exhausted to the outside air.

(b) Type 2 clothes dryers shall be exhausted to the outside air.

**4.15.3 Provisions for Make-up Air:**

(a) When a Type 1 clothes dryer is exhausted to the outside, consideration shall be given to provision for make-up air. (See 3.4.5.)

(b) Provision for make-up air shall be provided for Type 2 clothes dryers, with a minimum free area (see 3.4.4) of one square inch for each 1,000 Btu per hour total input rating of the dryer(s) installed.

**4.15.4 Exhaust Ducts for Type 1 Clothes Dryers:**

(a) A clothes dryer exhaust duct shall not be connected into any vent connector, gas vent, chimney, crawl space, attic or other similar concealed space.

*For details of protection refer to the Code for the Installation of Heat Producing Appliances, available from the American Insurance Association, 85 John Street, New York, N. Y. 10038.

(b) Ducts for exhausting clothes dryers shall not be put together with sheet-metal screws or other fastening means which extend into the duct and which would catch lint and reduce the efficiency of the exhaust system.

### 4.15.5 Exhaust Ducts for Type 2 Clothes Dryers:

(a) Exhaust ducts for Type 2 clothes dryers shall comply with 4.15.4.

(b) Exhaust ducts for Type 2 clothes dryers shall be constructed of sheet metal or other noncombustible material. Such ducts shall be equivalent in strength and corrosion resistance to ducts made of No. 24 Galvanized Sheet Gage steel.

(c) Type 2 clothes dryers shall be equipped or installed with lint controlling means.

(d) Exhaust ducts for Type 2 clothes dryers shall have a clearance of at least 6 inches to combustible material except as provided in 4.15.5(e).

(e) Exhaust ducts for Type 2 clothes dryers may be installed with reduced clearances to combustible material provided the combustible material is protected as described in Table 8.

(f) When ducts pass through walls, floors or partitions, the space around the duct shall be sealed with noncombustible material.

(g) Multiple installations of Type 2 clothes dryers shall be made in a manner to prevent adverse operation due to back pressures that might be created in the exhaust systems.

### 4.15.6 Multiple Family or Public Use:

Clothes dryers installed for multiple family or public use shall be equipped with approved safety shutoff devices.

## 4.16 *INCINERATORS*

### 4.16.1 Clearance:

(a) Listed incinerators shall be installed in accordance with their listing and the manufacturer's instructions, provided that in any case the clearance shall be sufficient to afford ready accessibility for firing, clean-out and necessary servicing.

(b) The clearances above a charging door to combustible material shall be not less than 48 inches. The clearance may be reduced to 24 inches provided the combustible material is protected with sheet metal not less than No. 28 manufacturer's stand-

ard gage spaced out 1 inch on noncombustible spacers, or equivalent protection. Such protection shall extend 18 inches beyond all sides of the charging door opening. Listed incinerators designed to retain the flame during loading need not comply with this paragraph.

(c) Unlisted incinerators shall be installed with clearances to combustible material of not less than 36 inches at the sides and top and not less than 48 inches at the front, but in no case shall the clearance above a charging door be less than 48 inches. Unlisted wall mounted incinerators shall be installed on a noncombustible wall communicating directly wtih a chimney.

(d) Domestic type incinerators may be installed with reduced clearances to combustible material in rooms, provided the combustible material is protected as described in Table 12. In confined spaces, such as alcoves, clearances shall not be so reduced.

(e) When a domestic type incinerator that is refractory lined or insulated with heat insulating material is encased in common brick not less than 4 inches in thickness, the clearances may be reduced to 6 inches at the sides and rear, and the clearance at the top may be reduced to 24 inches provided that the construction using combustible material above the charging door and within 48 inches is protected with No. 28 manufacturer's standard gage sheet metal spaced out 1 inch, or equivalent protection.

### 4.16.2 Mounting:

(a) Listed incinerators specifically listed for installation on combustible floors may be so installed.

(b) Unlisted incinerators, except as provided in 4.16.2 (c) and 4.16.2 (d), shall be mounted on the ground or on floors of fire-resistive construction with noncombustible flooring or surface finish and with no combustible material against the underside thereof, or on fire-resistive slabs or arches having no combustible material against the underside thereof. Such construction shall extend not less than 12 inches beyond the incinerator base on all sides except at the front or side where ashes are removed where it shall extend not less than 18 inches beyond the incinerator.

(c) Unlisted incinerators may be mounted on floors other than as specified in 4.16.2(b), provided the incinerator is so arranged that flame or hot gases do not come in contact with its base and, further, provided the floor under the incinerator is protected with hollow masonry not less than 4 inches thickness, covered with sheet metal of not less than 24 manufacturer's standard gage. Such masonry course shall be laid with ends unsealed and joints

matched in such a way as to provide a free circulation of air from side to side through the masonry. The floor for 18 inches beyond the front of the incinerator or side where ashes are removed and 12 inches beyond all other sides of the incinerator shall be protected with not less than ¼ inch asbestos millboard covered with sheet metal of not less than No. 24 manufacturer's standard gage or with protection equivalent thereto.

(d) Unlisted incinerators which are set on legs that provide not less than 4 inches open space under the base of the appliance may be mounted on floors other than as specified in paragraph 4.16.2 (b), provided the appliance is such that flame or hot gases do not come in contact with its base, and further provided the floor under the appliance is protected with asbestos millboard not less than ¼ inch thick covered with sheet metal of not less than No. 24 manufacturer's standard gage. The above specified floor protection shall extend not less than 18 inches beyond the front of the incinerator or side where ashes are removed and 12 inches beyond all other sides of the incinerator.

#### 4.16.3 Draft Hood Prohibited:

Draft hoods shall not be installed in the vent connector of an incinerator.

#### 4.16.4 Venting:

Incinerators shall be vented in accordance with 5.3, 5.6, 5.7 and 5.8.

### 4.17 *REFRIGERATORS*

#### 4.17.1 Clearance:

Refrigerators shall be provided with adequate clearances for ventilation at the top and back. They shall be installed in accordance with the manufacturer's instructions. If such instructions are not available, at least 2 inches shall be provided between the back of the refrigerator and the wall and at least a 12-inch clearance above the top.

#### 4.17.2 Venting or Ventilating Kits Approved For Use With a Refrigerator:

If an accessory kit is used for conveying air for burner combustion or unit cooling to the refrigerator from areas outside the room in which it is located, or for conveying combustion products diluted with air containing waste heat from the refrigerator to areas outside the room in which it is located, the kit shall be installed in accordance with the refrigerator manufacturer's instructions.

### 4.18 *HOT PLATES AND LAUNDRY STOVES*

(a) Listed domestic hot plates and laundry stoves installed on combustible surfaces shall be set on their own legs or bases. They shall be installed with minimum horizontal clearances of 6 inches from combustible material.

(b) Unlisted domestic hot plates and laundry stoves shall be installed with horizontal clearances to combustible material of not less than 12 inches. Combustible surfaces under unlisted domestic hot plates and laundry stoves shall be protected in an approved manner.*

(c) The vertical distance between tops of all domestic hot plates and laundry stoves and combustible material shall be at least 30 inches.

### 4.19 *FLOOR MOUNTED COMMERCIAL COOKING EQUIPMENT*

#### 4.19.1 Clearance for Listed Appliances:

Listed floor-mounted commercial cooking appliances, such as hotel and restaurant ranges, deep fat fryers, unit broilers, gas-fired kettles, steam cookers, steam generators and portable baking and roasting ovens, shall be installed at least 6 inches from combustible material except that at least 2 inches clearance shall be maintained between the flue box or draft hood and combustible material. Floor-mounted commercial cooking appliances listed for installation at lesser clearances may be installed in accordance with their listing and the manufacturer's instructions. Appliances designed and marked "For use only in fire-resistive locations" shall not be installed elsewhere.

#### 4.19.2 Clearance for Unlisted Appliances:

(a) Unlisted floor-mounted commercial cooking appliances, except as provided in 4.19.2 (b) and (c), shall be installed to provide a clearance to combustible material of not less than 18 inches at the sides and rear of the appliance and from the vent connector and not less than 48 inches above cooking tops and at the front of the appliance.

(b) Unlisted floor-mounted commercial cooking appliances may be installed in rooms, but not in confined spaces such as alcoves, with reduced clearances to combustible material, provided the combustible material or the appliance is protected as described in Table 8.

*For details of protection refer to the Code for the Installation of Heat Producing Appliances, available from the American Insurance Association, 85 John Street, New York, N. Y., 10038.

(c) Unlisted floor-mounted commercial cooking appliances may be installed in rooms, but not in confined spaces such as alcoves, with reduced clearance of 6 inches to combustible material, provided the wall or combustible material is protected by sheet metal of not less than No. 26 manufacturer's standard gage, fastened with noncombustible spacers that are spaced at not less than 2-foot vertical and horizontal intervals to provide a clearance of 1½ inches from such wall or material. Such protection shall extend at least 12 inches beyond the back, side, top or any other part of the appliance and the space between the sheet metal and wall or combustible material shall be open on both sides and top and bottom to permit circulation of air.

### 4.19.3 Mounting on Combustible Floor:

(a) Listed floor-mounted commercial cooking appliances that are listed specifically for installation on floors constructed of combustible material may be mounted on combustible floors in accordance with their listing.

(b) Listed floor-mounted commercial cooking appliances that are designed and marked "For use only in fire-resistive locations" shall be mounted on floors of fire-resistive construction with noncombustible flooring and surface finish and with no combustible material against the underside thereof, or on fire-resistive slabs or arches having no combustible material against the underside thereof. Such construction shall in all cases extend not less than 12 inches beyond the appliance on all sides.

(c) Floor-mounted commercial cooking appliances which are not listed for mounting on a combustible floor shall be mounted in accordance with 4.19.3 (b) or be mounted in accordance with one of the following:

1. When the appliance is set on legs which provide not less than 18 inches open space under the base of the appliance, or where it has no burners and no portion of any oven or broiler within 18 inches of the floor, it may be mounted on a combustible floor without special floor protection, provided there is at least one sheet metal baffle between the burner and the floor.

2. When the appliance is set on legs which provide not less than 8 inches open space under the base of the appliance, it may be mounted on combustible floors provided the floor under the appliance is protected with not less than ⅜ inch asbestos millboard covered with sheet metal of not less than No. 24 manufacturer's standard gage. The above specified

floor protection shall extend not less than 6 inches beyond the appliance on all sides.

3. When the appliance is set on legs which provide not less than 4 inches under the base of the appliance, it may be mounted on combustible floors, provided the floor under the appliance is protected with hollow masonry not less than 4 inches in thickness covered with sheet metal of not less than No. 24 manufacturer's standard gage. Such masonry courses shall be laid with ends unsealed and joints matched in such a way as to provide for free circulation of air through the masonry.

4. When the appliance does not have legs at least 4 inches high, it may be mounted on combustible floors, provided the floor under the appliance is protected by two courses of 4-inch hollow clay tile or equivalent with courses laid at right angles and with ends unsealed and joints matched in such a way as to provide for free circulation of air through such masonry courses and covered with steel plate not less than 3/16 inch in thickness.

**4.19.4 Combustible Material Adjacent to Cooking Top:**

Any portion of combustible material adjacent to a cooking top section of a hotel and restaurant range, even though listed for close-to-wall installation, which is not shielded from the wall by a high shelf, warming closet, etc., shall be protected as specified in 4.19.2 for a distance of at least 2 feet above the surface of the cooking top.

**4.19.5 Install Level:**

Floor-mounted commercial cooking appliances shall be installed level on a firm foundation.

**4.19.6 Ventilation:**

Adequate means shall be provided to properly ventilate the space in which commercial cooking equipment is installed to permit proper combustion of the gas. When exhaust fans are used for ventilation, special precautions may be necessary to avoid interference with the operation of the equipment.

## 4.20 *COMMERCIAL COUNTER APPLIANCES*

**4.20.1 Vertical Clearance:**

A vertical distance of not less than 48 inches shall be provided between the top of all commercial hot plates and griddles and combustible material.

### 4.20.2 Clearance for Listed Appliances:

Listed counter appliances such as commercial hot plates and griddles, food and dish warmers, and coffee brewers and urns, when installed on combustible surfaces shall be on their own bases or legs, and shall be installed with a minimum horizontal clearance of 6 inches from combustible material except that at least a 2-inch clearance shall be maintained between the flue box or draft hood and combustible material. Counter appliances listed for installation at lesser clearances may be installed in accordance with their listing and the manufacturer's instructions.

### 4.20.3 Clearance for Unlisted Appliances:

Unlisted commercial hot plates and griddles shall be installed with a horizontal clearance from combustible material of not less than 18 inches. Unlisted gas commercial counter appliances such as coffee brewers and urns, waffle bakers and hot water immersion sterilizers shall be installed with a horizontal clearance from combustible material of not less than 12 inches. Gas commercial counter appliances may be installed with reduced clearances to combustible material provided the combustible material is protected as described in Table 8. Unlisted food and dish warmers shall be installed with a horizontal clearance from combustible material of not less than 6 inches.

### 4.20.4 Mounting of Unlisted Appliances:

Unlisted commercial counter appliances shall not be set on combustible material unless they have legs which provide not less than 4 inches of open space below the burners, and the combustible surface is protected with asbestos millboard at least ¼ inch thick covered with sheet metal of not less than No. 28 manufacturer's standard gage, or with equivalent protection.

## 4.21 *AIR CONDITIONING APPLIANCES*

### 4.21.1 Independent Gas Piping:

Gas piping serving a heating appliance may also serve a cooling appliance when heating and cooling appliances cannot be operated simultaneously. (See 2.4.)

### 4.21.2 Connection of Gas Engine-Powered Air Conditioners:

To protect against the effects of normal vibration in service, gas engines shall not be rigidly connected to the gas supply piping.

### 4.21.3 Manual Main Shutoff Valves:

When a complete shutoff type safety shutoff device is not utilized, a manual main shutoff valve shall be provided ahead of all controls except the manual pilot gas valve.

When a complete shutoff type safety shutoff device is utilized, a manual main shutoff valve shall be provided ahead of all controls.

A union connection shall be provided downstream from the manual main shutoff valve to permit removal of the controls.

### 4.21.4 Clearances for Indoor Installation:

(a) Listed air conditioning appliances installed in rooms which are large in comparison with the size of the appliance, shall be installed with clearances not less than specified in Line I of Table 7 except as provided in 4.21.4(a) 1, 2 and 3.

1. Air conditioning appliances listed for installation at lesser clearances than specified in Table 7 may be installed in accordance with their listing and the manufacturer's instructions.

2. Air conditioning appliances listed for installation at greater clearances than specified in Table 7 shall be installed in accordance with their listing and the manufacturer's instructions unless protected as specified in 4.21.4(a) 3.

3. Air conditioning appliances installed in unconfined spaces may be installed with reduced clearances to combustible material provided the combustible material or the appliance is protected as described in Table 8.

(b) Air conditioning appliances installed in confined spaces shall be installed in accordance with their listing and, when such units are installed in spaces such as alcoves and closets, they shall be specifically listed for such installation. The installation clearances for air conditioning appliances in confined spaces shall not be reduced by the protection methods described in Table 8.

(c) Unlisted air conditioning appliances shall be installed with clearances from combustible material of not less than 18 inches above the appliance and at sides, front and rear, and 9 inches from projecting flue box or draft hood.

(d) When the plenum for an air conditioner which includes provisions for heating air is adjacent to combustible material, the clearance shall be measured to the surface of the plaster or other noncombustible finish when the clearance specified is 2 inches or less.

(e) The clearance to these appliances shall not interfere with combustion air, draft hood clearance and relief, and accessibility for servicing. (See 3.2.4, 3.3.1 and 3.4.)

### 4.21.5 Erection and Mounting:

An air conditioning appliance shall be erected in accordance with the manufacturer's instructions. Unless the appliance is listed for installation on a combustible surface such as a floor or roof, or the surface is protected in an approved manner,* it shall be installed on a surface of fire-resistive construction with noncombustible material and surface finish and with no combustible material against the underside thereof.

### 4.21.6 Connection of Flow and Return Piping:

The method of connecting the flow and return piping on air conditioning appliances which provide heated or chilled fluid shall be in accordance with the manufacturer's recommendations to facilitate a positive, balanced and unobstructed flow through the system.

### 4.21.7 Cooling Towers:

A cooling tower used in conjunction with an air conditioning appliance shall be installed in accordance with the manufacturer's installation instructions. The cooling tower shall be provided with a direct connection to a water supply through an individual control valve. A means by which the tower may be flushed or drained shall be provided.

### 4.21.8 Plenum Chambers and Air Ducts:

A plenum chamber supplied as a part of an air conditioning appliance shall be installed in accordance with the manufacturer's instructions. When a plenum chamber is not supplied with the appliance, any fabrication and installation instructions provided by the manufacturer shall be followed. The method of connecting supply and return ducts shall facilitate proper circulation of air.**

When the air conditioner is installed within a confined space, the air circulated by the appliance shall be handled by ducts which are sealed to the casing of the appliance and which separate the circulating air from the combustion and ventilation air.

### 4.21.9 Refrigeration Coils:

(See 4.7.11 and 4.7.12.)

*For details of protection see the Code for the Installation of Heat Producing Appliances, available from the American Insurance Association, 85 John Street, New York, N. Y. 10038.

**Reference may be made to the Standard for the Installation of Air Conditioning and Ventilating Systems, NFPA No. 90A, Standard for the Installation of Residence Type Warm Air Heating and Air Conditioning Systems, NFPA No. 90B, available from the National Fire Protection Association, 60 Batterymarch St., Boston, Mass. 02110.

### 4.21.10 Switches in Electrical Supply Line:

Means for interrupting the electrical supply to the air conditioning appliance and to its associated cooling tower (if supplied and installed in a location remote from the air conditioner) shall be provided within sight of and not over 50 feet from the air conditioner and cooling tower.

## 4.22 *ILLUMINATING APPLIANCES*

### 4.22.1 Clearances for Listed Appliances:

Listed illuminating appliances shall be installed in accordance with their listings and the manufacturer's instructions.

### 4.22.2 Clearances for Unlisted Appliances:

(a) *Enclosed type.*

1. Unlisted enclosed illuminating appliances installed outdoors shall be installed with clearances in any direction from combustible material of not less than 12 inches.

2. Unlisted enclosed illuminating appliances installed indoors shall be installed with clearances in any direction from combustible material of not less than 18 inches.

(b) *Open-flame type.*

1. Unlisted open-flame illuminating appliances installed outdoors shall have clearances from combustible material not less than that specified in Table 9. The distance from ground level to the base of the burner shall be at least seven (7) feet when installed within two feet of walkways.
Lesser clearances may be used when acceptable to the authority having jurisdiction.

2. Unlisted open-flame illuminating appliances installed outdoors shall be equipped with a limiting orifice or other limiting device which will maintain a flame height consistent with the clearance from combustible material, as given in Table 9.

3. Appliances designed for flame heights in excess of 30 inches may be installed if acceptable to the authority having jurisdiction. Such appliances shall be equipped with a safety shutoff device or automatic ignition.

4. Unlisted open-flame illuminating appliances installed indoors shall have clearances from combustible material acceptable to the authority having jurisdiction.

Table 9

| Flame Height Above Burner Head, Inches | Minimum Clearance from Combustible Material, Feet* | |
|---|---|---|
| | Horizontal | Vertical |
| 12 | 2 | 6 |
| 18 | 3 | 8 |
| 24 | 3 | 10 |
| 30 | 4 | 12 |

*Measured from the nearest portion of the burner head.

### 4.22.3 Mounting on Buildings:

Illuminating appliances designed for wall or ceiling mounting shall be securely attached to substantial structures in such a manner that they are not dependent on the gas piping for support.

### 4.22.4 Mounting on Posts:

Illuminating appliances designed for post mounting shall be securely and rigidly attached to a post.

Posts shall be rigidly mounted. The strength and rigidity of posts greater than three feet in height shall be at least equivalent to that of a 2½ inch diameter post constructed of 0.064 inch thick (No. 14 gage) steel or a one-inch schedule 40 steel pipe. Posts three feet or less in height shall not be smaller than a ¾ inch schedule 40 steel pipe.

Drain openings should be provided near the base of posts when there is a possibility of water collecting inside them.

### 4.22.5 Manual Shutoff Valves:

An approved manual shutoff valve shall be installed at or near the base of, or readily accessible to, unlisted open-flame illuminating devices.

### 4.22.6 Gas Pressure Regulators:

When a gas appliance pressure regulator is not supplied with an illuminating appliance and the service line is not equipped with a service pressure regulator, it is recommended that an appliance pressure regulator be installed in the line to the illuminating appliance. For multiple installations, one regulator of adequate capacity may be used to serve a number of illuminating appliances.

## 4.23 *VENTED DECORATIVE APPLIANCES*

### 4.23.1 Installation:

(a) Listed vented decorative appliances shall be installed in accordance with their listing and the manufacturer's instructions. They may be installed in or attached to combustible material when so listed.

(b) Unlisted vented decorative appliances shall not be installed in or attached to combustible material. They shall have clearance at sides and rear of not less than 18 inches; except that appliances which make use of metal, asbestos or ceramic material to direct radiation to the front of the appliance shall have a clearance of 36 inches in front, and if constructed with a double back of metal or ceramic may be installed with a clearance of 18 inches at sides and 12 inches at rear. Combustible floors under unlisted vented decorative appliances shall be protected in an approved manner.*

(c) Panels, grilles and access doors which must be removed for normal servicing operations shall not be attached to the building.

### 4.23.2 Manual Main Shutoff Valve:

A manual main shutoff valve shall be installed ahead of all controls including the pilot gas valve.

### 4.23.3 Combustion and Circulating Air:

Adequate combustion and circulating air shall be provided (see 3.4).

## 4.24 *STATIONARY GAS ENGINES*

The installation of gas engines shall conform with the Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines, NFPA No. 37-1967.**

*For details of protection, refer to mounting provisions for unlisted room heaters in the Code for the Installation of Heat Producing Appliances, available from the American Insurance Association, 85 John St., New York, New York 10038.

**Available from the National Fire Protection Association, 60 Batterymarch St., Boston, Mass. 02110.

# Part 5 — Venting of Appliances

## 5.1 *SPECIFICATIONS FOR VENTING*

### 5.1.1 Appliances Required to be Vented:

Appliances of the following types shall be provided with venting systems or other means for removing the flue gases to the outside atmosphere.

(a) Steam and hot water boilers, warm air furnaces, floor furnaces, and wall furnaces.

(b) Unit heaters and duct furnaces.

(c) Incinerators.

(d) Water heaters with inputs over 5,000 Btu per hour, except as provided under 5.1.2 (f) and (g).

(e) Built-in domestic cooking units listed and marked only as vented units.

(f) Room heaters listed only for vented use. Room heaters listed as "vented and unvented" units may be installed unvented subject to approval of the authority having jurisdiction. (See also 4.6.1 and 4.6.2.)

(g) Type 2 clothes dryers (see 4.15.2 and 4.15.5).

(h) Appliances equipped with gas conversion burners.

(i) Other listed appliances which have draft hoods supplied by the appliance manufacturer.

(j) Unlisted appliances, except as provided under 5.1.2 (1).

### 5.1.2 Appliances Not Required to be Vented:

(a) Listed ranges.

(b) Built-in domestic cooking units listed and marked as unvented units.

(c) Listed hot plates and listed laundry stoves.

(d) Listed Type 1 clothes dryers (see 4.15.2).

★(e) Listed water heaters with inputs not over 5,000 Btu per hour.

★(f) Automatically controlled instantaneous water heaters which supply water to a single faucet which is attached to and made a part of the appliance (see 4.5.1).

★(g) A single listed booster type (automatic instantaneous) water heater when designed and used solely for the sanitizing rinse requirements of a National Sanitation Foundation Class 1, 2 or 3

dishwashing machine, provided that the input is limited to 50,000 Btu per hour, the storage capacity is limited to 12.5 gallons, and the heater is installed, with the draft hood in place and unaltered, in a commercial kitchen having a mechanical exhaust system. When installed in this manner, the draft hood outlet shall be not less than 36 inches vertically and 6 inches horizontally from any surface other than the heater.

★(h) Listed refrigerators.

★(i) Counter appliances.

★(j) Room heaters listed for unvented use (see 4.6.1 and 4.6.2).

★(k) Other appliances listed for unvented use and not provided with flue collars.

★(l) Specialized equipment of limited input such as laboratory burners or gas lights.

When any or all of the appliances starred above (★) are installed so that the aggregate input rating exceeds 30 Btu per hour per cubic foot of room or space in which they are installed, one or more of them shall be provided with a venting system or other approved means for removing the vent gases to the outside atmosphere so that the aggregate input rating of the remaining unvented appliances does not exceed the 30 Btu per hour per cubic foot figure. When the room or space in which they are installed is directly connected to another room or space by a doorway, archway, or other opening of comparable size, which cannot be closed, the volume of such adjacent room or space may be included in the calculations.

## 5.2 *MINIMUM SAFE PERFORMANCE*

**5.2.1** (a) Venting systems shall be engineered and constructed so as to develop a positive flow adequate to remove flue gases to the outside atmosphere.

(b) When venting systems serve appliances requiring draft for proper operation they shall be designed and installed to develop adequate draft so as to satisfy the draft requirements of the appliance in accordance with the manufacturer's instructions.

**5.2.2 Design and Construction:**

Gas appliances required to be vented shall be connected to a venting system, except as provided in 5.9. The venting system shall be designed and constructed in accordance with one of the following methods:

(a) Natural draft provisions of 5.3 through 5.8.

(b) Natural draft systems designed in accordance with approved engineering methods and installed in accordance with the plans and specifications of that design.

(c) Special venting arrangements of 5.9.

**5.2.3** No portion of a venting system shall extend into or pass through any circulating air duct or plenum.

## 5.3 *TYPE OF VENTING SYSTEM TO BE USED*

**5.3.1 Chimneys shall be used for venting the following types of appliances:**

(a) Incinerators, except as provided in 5.3.4(b) and 5.9.2(a).

(b) Appliances which may be converted to the use of solid or liquid fuels.

**5.3.2** Listed gas appliances equipped with draft hoods and other gas appliances listed for use with Type B gas vents may be connected to Type B gas vents except as provided in 5.3.1, 5.3.3 and 5.9.1.

**5.3.3** Type BW gas vents shall be used with listed vented wall furnaces when the appliance is so listed.

**5.3.4** Single-wall metal pipe may be used in accordance with 5.7 for venting the following:

(a) Gas appliances except as provided in 5.3.1 and 5.3.3.

(b) Incinerators used outdoors such as in open sheds, breezeways, or carports as provided in 5.7.3(c).

**5.3.5** Type L venting systems may be used for venting appliances listed for use with Type L venting systems.

## 5.4 *OUTSIDE GAS VENTS AND CHIMNEYS*

**5.4.1 Materials:**

Outside uninsulated single-wall pipe is not recommended for use in cold climates for venting appliances equipped with draft hoods because temperature differentials may cause condensation corrosion in such pipe.

**5.4.2 Condensate Drain:**

When local experience indicates that condensate may be a problem, provisions shall be made to drain off the condensate.

## 5.5 *INSTALLATION OF GAS VENTS AND VENTING SYSTEMS*

### 5.5.1 Application:

(a) Type B and Type BW gas vents shall be installed in accordance with their listings and the manufacturer's instructions.

(b) Type B and Type BW gas vents may be used for single or multiple story installation if so listed.

(c) A Type BW gas vent shall have a listed capacity not less than that of the listed vented wall furnace to which it is connected.

(d) A Type L venting system shall be installed in accordance with its listing and the manufacturer's instructions.

(e) Vents and venting systems passing through roofs shall extend through the roof flashing, roof jack or roof thimble.

### 5.5.2 Gas Vent Termination:

Type B and Type BW gas vents and Type L venting systems shall terminate in accordance with the following as appropriate:

(a) Type B and Type BW gas vents and Type L venting systems employing a listed cap or a listed roof assembly shall terminate in accordance with the terms of their respective listings and the manufacturer's instructions.

(b) Type B and Type BW gas vents and Type L venting systems terminating other than in accordance with 5.5.2(a) shall extend at least 2 feet above the highest point where they pass through a roof of the building and at least 2 feet higher than any portion of a building within a horizontal distance of 10 feet. (See Figure 13.)

(c) A gas vent and a venting system may be connected to a chimney terminating in accordance with 5.6.2.

(d) A Type B gas vent shall terminate not less than 5 feet in vertical height above the highest connected appliance draft hood or flue collar.

(e) A Type BW gas vent serving a vented wall furnace shall terminate not less than 12 feet above the bottom of the furnace.

(f) Vents, except those of listed sealed combustion system appliances (5.9.1) and mechanical draft systems (5.9.3) extending through an outside wall, shall not terminate adjacent to the wall or below eaves or parapets.

### 5.5.3 Size of Gas Vents:

(a) Vents shall be sized and constructed in accordance with approved engineering methods. Reference may be made to Tables 1

through 6 in Appendix D, depending on the construction of the vent. As an alternate method for sizing an individual vent for a single appliance only, the effective area of the vent connector and vent shall be not less than the area of the appliance draft hood outlet. As an alternate method for sizing a vent connected to more than one appliance, the effective area of the vent shall be not less than the area of the largest vent connector plus 50 percent of the areas of additional draft hood outlets.

(b) A cap or roof assembly shall have a venting capacity not less than that of the gas vent to which it is attached.

(c) The sizing required in 5.5.3(a) shall not apply to Section 5.9. However, all installations made with sealed combustion system appliances and mechanical draft systems shall comply with 5.2.1 and 5.9.

### 5.5.4 Gas Vents Serving Appliances on More Than One Floor:

A single or common Type B gas vent is permissible in multistory installations to vent gas appliances located on more than one floor level provided the venting system is engineered and installed in accordance with an approved engineering method.

### 5.5.5 Support of Gas Vents:

All portions of gas vents shall be adequately supported for the design and weight of the materials employed. Listed gas vents shall be supported and spaced in accordance with their listings and the manufacturer's instructions.

### 5.5.6 Marking:

In those localities where solid and liquid fuels are used extensively, gas vents shall be plainly and permanently identified by a label reading:

> "This gas vent is for appliances which burn gas only.
> Do not connect to incinerators or solid or liquid fuel burning appliances."

This label shall be attached to the wall or ceiling at a point near where the gas vent connector enters the wall, ceiling or chimney.

The authority having jurisdiction shall determine whether their area constitutes such a locality.

## 5.6 *MASONRY, METAL AND FACTORY-BUILT CHIMNEYS*

### 5.6.1 Listing or Construction:

(a) Factory-built chimneys shall be installed in accordance with their listings and the manufacturer's instructions.

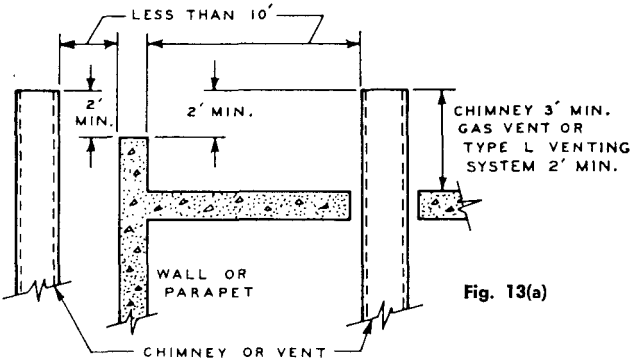



Fig. 13(a)

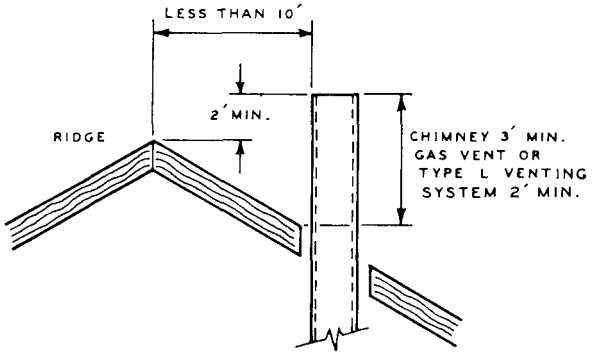



Fig. 13(b)

**Fig. 13. Typical Termination Locations for Gas Vents and Chimneys. (Termination Less than 10 Feet From Ridge, Wall or Parapet)**

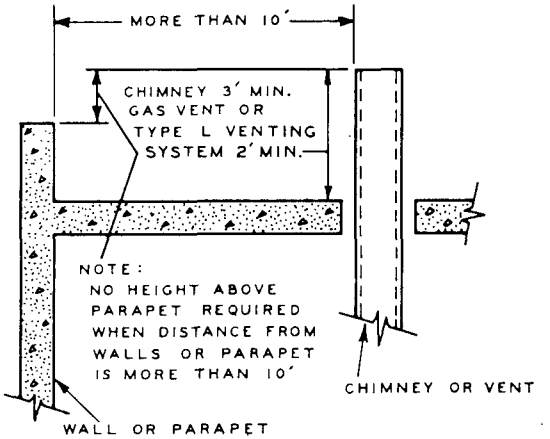



**Fig. 13(c)**

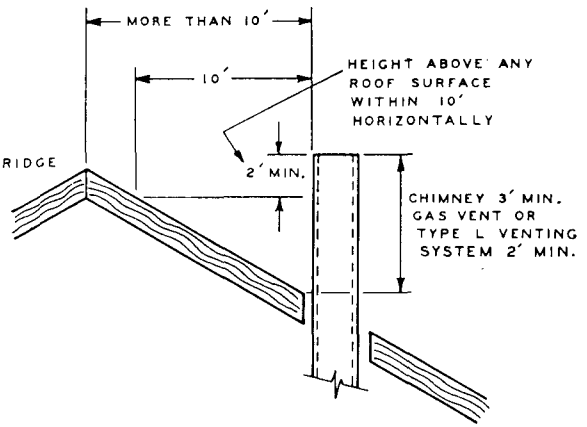



**Fig. 13(d)**

**Fig. 13. Typical Termination Locations for Gas Vents and Chimneys. (Termination More than 10 Feet From Ridge, Wall or Parapet)**

(b) Masonry or metal chimneys shall be built and installed in accordance with nationally recognized building codes or standards.*

### 5.6.2 Termination:

(a) Chimneys shall extend at least 3 feet above the highest point where they pass through a roof of a building and at least 2 feet higher than any portion of a building within a horizontal distance of 10 feet. (See Figure 13.)

(b) Chimneys shall extend at least 5 feet above the highest connected appliance draft hood outlet or flue collar.

### 5.6.3 Size of Chimneys:

(a) The effective area of chimney venting systems shall be in accordance with approved engineering methods. Reference may be made to Tables 3 and 6 in Appendix D. As an alternate method of sizing individual chimney venting systems for a single appliance only, the effective area of the connector and the chimney flue shall be not less than the area of the appliance draft hood outlet. As an alternate method for sizing a chimney connected to more than one appliance, the effective area of the chimney flue shall be not less than the area of the largest vent connector plus 50 percent of the area of additional draft hood outlets.

(b) When an incinerator is vented by a chimney serving other gas appliances, the gas input to the incinerator need not be included in calculating chimney flue size provided the chimney flue diameter is not less than 1 inch larger in equivalent diameter than the diameter of the incinerator flue outlet.

(c) The sizing provisions of 5.6.3(a) shall not apply to Section 5.9. However, all mechanical draft systems shall comply with 5.2.1 and 5.9.3.

### 5.6.4 Inspection of Chimneys:

(a) Before connecting a vent connector to a chimney, the chimney passageway shall be examined to ascertain that it is clear and free of obstructions.

(b) Cleanouts shall be constructed so that they will remain tightly closed when not in use. Tee fittings used as cleanouts or condensate drains shall have tight-fitting caps to prevent entrance of air into the chimney at those points.

*Article X of the National Building Code of The American Insurance Association, 85 John St., New York, N.Y. 10038, or the Standard for Chimneys, Fireplaces & Venting Systems, NFPA No. 211 of the National Fire Protection Association, 60 Batterymarch St., Boston, Mass. 02110, are among such nationally recognized codes and standards.

(c) When an existing masonry chimney is unlined and local experience indicates that vent gas condensate may be a problem, an approved liner or another vent shall be installed. When inspection reveals that an existing chimney is not safe for the intended application it shall be rebuilt to conform to nationally recognized standards, relined with a suitable liner, or replaced with a gas vent or chimney suitable for the appliances to be attached.

### 5.6.5 Chimneys Serving Appliances Burning Other Fuels:

An automatically controlled gas appliance connected to a chimney which also serves equipment for the combustion of solid or liquid fuel shall be equipped with a safety shutoff device. (See also 5.8.4.)

### 5.6.6 Support of Chimneys:

All portions of chimneys shall be adequately supported for the design and weight of the materials employed. Listed factory-built chimneys shall be supported and spaced in accordance with their listings and the manufacturer's instructions.

## 5.7 *SINGLE-WALL METAL PIPE*

### 5.7.1 Construction:

Single-wall metal pipe shall be constructed of sheet copper not less than No. 24 B&S gage, galvanized sheet steel not less than No. 20 galvanized sheet gage, or other approved noncombustible corrosion-resistant material.

### 5.7.2 Termination:

(a) Single-wall metal pipe shall not terminate less than 5 feet in vertical height above the highest connected appliance draft hood outlet or flue collar.

(b) Single-wall metal pipe shall extend at least 2 feet above the highest point where it passes through a roof of a building and at least 2 feet higher than any portion of a building within a horizontal distance of 10 feet. (See Figure 13.)

### 5.7.3 Installation With Appliances Permitted by 5.3.4:

(a) Single-wall metal pipe shall be used only for runs directly from the space in which the appliance is located through the roof or exterior wall to the outer air. A pipe passing through a roof shall extend without interruption through roof flashing, roof jack or roof thimble.

(b) Single-wall metal pipe shall not originate in any unoccupied attic or concealed space, and shall not pass through any attic, inside wall, concealed space, or through any floor.

(c) Single-wall metal pipe used for venting incinerators shall be exposed and readily examinable for its full length and suitable clearances maintained. (See Table 10.)

(d) Minimum clearances from single-wall metal pipe to combustible material shall be in accordance with Table 10. The clearance from single-wall metal pipe to combustible material may be reduced when the combustible material is protected as specified for vent connectors in Table 8.

(e) When a single-wall metal pipe passes through an exterior wall constructed of combustible material, it shall be guarded at the point of passage by a method described in 5.8.15.

(f) When a single-wall metal pipe passes through a roof constructed of combustible material it shall be guarded at the point of passage by a method described in 5.8.15 or by a noncombustible nonventilating thimble not less than 4 inches larger in diameter

**Table 10**

**Clearances for Connectors**

| Appliance | Minimum Distance from Combustible Material | | |
|---|---|---|---|
| | Listed Type B Gas Vent Material | Listed Type L Venting System Material | Connectors of Other than Type B or Type L Material |
| Listed appliances with draft hoods and appliances listed for use with Type B Gas Vents | as listed | as listed | 6 inches |
| Boilers and furnaces with listed gas conversion burner and with draft hood | 6 inches | 6 inches | 9 inches |
| Appliances listed for use with Type L venting systems | not permitted | as listed | 9 inches |
| Residential Incinerators | not permitted | 9 inches | 18 inches |
| Unlisted appliances with draft hood | not permitted | 6 inches | 9 inches |
| Appliances other than those above | not permitted | 9 inches | 18 inches |

than the vent pipe and extending not less than 18 inches above and 6 inches below the roof with the annular space open at the bottom and closed only at the top.

### 5.7.4 Size of Single-Wall Metal Pipe:

(a) Single-wall metal pipe shall be sized and constructed in accordance with approved engineering methods. Reference may be made to Tables 2 and 5 in Appendix D. As an alternate method for sizing an individual pipe for a single appliance only, the effective area of the connector and the pipe shall be not less than the area of the appliance draft hood outlet. As an alternate method for sizing a pipe connected to more than one appliance, the effective area of the pipe shall be not less than the area of the largest connector plus 50 percent of the area of additional draft hood outlets.

(b) Any shaped single-wall metal pipe may be used, providing its equivalent effective area is equal to the effective area of the round pipe for which it is substituted and the minimum internal dimension of the pipe is not less than 2 inches.

(c) If used, a cap or a roof assembly shall have a venting capacity not less than that of the pipe to which it is attached.

### 5.7.5 Support of Single-Wall Metal Pipe:

All portions of single-wall metal pipe shall be adequately supported for the design and weight of the material employed.

### 5.7.6 Marking:

Single-wall metal pipe shall comply with the marking provisions of 5.5.6.

## 5.8 *VENT CONNECTORS*

### 5.8.1 When Required:

Vent connectors shall be used to connect gas appliances to the gas vent, chimney or single-wall metal pipe except when the gas vent, chimney or single-wall metal pipe is directly connected to the appliance.

### 5.8.2 Materials:

(a) Vent connectors used for gas appliances having draft hoods and for appliances having draft hoods and equipped with listed conversion burners shall be constructed of materials having a resistance to corrosion and heat not less than that of No. 28 galvanized sheet gage steel, No. 26 B&S gage copper or No. 24 B&S gage aluminum, except as provided in 5.8.2(b).

(b) Vent connectors serving listed gas appliances with draft hoods and other appliances listed for use with Type B vents may be constructed of Type B gas vent material.

(c) Vent connectors made of Type L venting system material may be used with gas or combination gas-oil fuel-burning residential appliances including residential type incinerators.

(d) Vent connectors used for appliances other than those described in paragraphs 5.8.2 (a), (b) and (c) shall be constructed of materials having a resistance to corrosion and heat not less than that of No. 24 galvanized sheet gage steel, or No. 22 B&S gage copper.

**5.8.3 Size of Vent Connector:**

(a) Vent connectors for appliances with a single draft hood shall be sized and constructed in accordance with approved engineering methods. Reference may be made to Tables 1, 2 and 3 in Appendix D, depending on the construction of the connector. As an alternate method the effective area of the connector shall be not less than the area of the draft hood outlet.

(b) For single appliances having more than one draft hood outlet, the manifold shall be constructed according to the instructions of the appliance manufacturer. If there are no instructions, the manifold shall be constructed in accordance with approved engineering methods. As a second alternate, the effective area of the manifold shall equal the combined areas of the draft hood outlets.

(c) When two or more gas appliances are connected to a common vent or chimney, the effective area of each vent connector shall be in accordance with approved engineering methods. Reference may be made to Tables 4, 5 and 6 in Appendix D. As an alternate method each vent connector shall have an effective area not less than the area of the draft hood outlet of the appliance to which it is connected.

(d) The vertical rise of each vent connector of a multiple venting system shall be in accordance with approved engineering methods. Reference may be made to Tables 4, 5 and 6 in Appendix D.

(e) When the size of a connector is increased to overcome installation limitations and obtain connector capacity equal to the appliance input, the size increase shall be made at the appliance draft hood outlet.

(f) The effective area of the vent connector, when connected to one or more appliances requiring draft for operation, shall be obtained by the application of approved engineering methods to perform as specified in 5.2.1.

### 5.8.4 Two or More Appliances Connected to a Single Vent:

(a) When two or more vent connectors enter a common gas vent, chimney, or single-wall metal pipe, the smaller connector should enter at the highest level consistent with the available headroom or clearance to combustible material.

(b) Two or more gas appliances may be vented through a common vent connector or manifold. The common vent connector or manifold shall be located at the highest level consistent with available headroom or clearance to combustible material, and shall be sized in accordance with approved engineering methods. Reference may be made to Tables 4, 5 and 6 in Appendix D. As an alternate method the area of the common vent connector or manifold and all junction fittings shall be not less than the combined areas of the draft hood outlets or of the individual vent connectors.

(c) A gas appliance and an appliance burning another fuel may be connected to one chimney through separate openings or may be connected through a single opening if joined by a suitable fitting located as close as practical to the chimney. If two or more openings are provided into one chimney they should be at different levels. If the gas appliance is automatically controlled it shall be equipped with a safety shutoff device.

### 5.8.5 Clearance:

Minimum clearances from vent connectors to combustible material shall be in accordance with Table 10. The clearances from vent connectors to combustible materials may be reduced when the combustible material is protected as specified for vent connectors in Table 8.

When vent connectors must pass through walls or partitions of combustible material, a thimble shall be used and installed in accordance with one of the methods outlined in 5.8.15.

### 5.8.6 Avoid Unnecessary Bends:

The vent connector shall be installed so as to avoid excessive turns or other construction features which create unnecessary resistance to flow of vent gases.

### 5.8.7 Joints:

Vent connectors shall be firmly attached to draft hood outlets or flue collars by sheet-metal screws or other approved means.

Vent connectors using listed Type B or Type L gas vent material shall be securely assembled using the method shown in the manufacturer's instructions.

Joints of other than listed gas vent material shall be securely fastened by sheet-metal screws or other approved methods.

### 5.8.8 Pitch:

Vent connectors shall be installed without any downward pitch from the appliance and without any dips or sags.

Vent connectors attached directly to side outlet draft hoods, such as on floor furnaces, shall be pitched upward from the appliance at least ¼ inch per foot.

### 5.8.9 Length:

The horizontal run of the vent connector shall be as short and direct as possible. The maximum length of a single-wall vent connector venting one appliance shall not exceed 75 percent of the height of the gas vent. The maximum length of a Type B double-wall vent connector, venting one appliance, shall not exceed 100 percent of the height of the gas vent. When greater lengths of connectors are necessary, they shall be constructed in accordance with approved engineering methods.

Combined venting systems shall be in accordance with Tables 4, 5, or 6 of Appendix D.

### 5.8.10 Support:

Vent connectors shall be adequately supported for the design and weight of the materials employed to maintain proper clearances, to prevent physical damage, and to prevent separation of the joints.

### 5.8.11 Location:

When the vent connector used for an appliance having a draft hood must be located in or pass through a crawl space or other area difficult of access which may be cold, that portion of the vent connector shall be of listed double-wall Type B gas vent material or material having equivalent insulation qualities. Single-wall metal pipe used as a vent connector shall not pass through any floor or ceiling.

### 5.8.12 Chimney Connection:

In entering a passageway in a masonry or metal chimney the vent connector shall be installed above the extreme bottom to avoid stoppage. Means shall be employed which will prevent the vent connector from entering so far as to restrict the space between its end and the opposite wall of the chimney. A thimble or slip joint

may be used to facilitate removal of the connector. The vent connector shall be firmly attached to or inserted into the thimble or slip joint to prevent the vent connector from falling out.

### 5.8.13 Fireplace:

A vent connector shall not be connected to a chimney flue serving a fireplace unless the fireplace opening is permanently sealed.

### 5.8.14 Dampers:

Manually operated dampers shall not be placed in the vent connectors from gas appliances except that manually operated dampers may be installed in the vent connector of listed gas incinerators when recommended by the manufacturer. Such a damper or draft regulator shall be installed in accordance with the instructions accompanying the incinerator. Fixed baffles, such as baffles ahead of draft hoods are not classified as dampers.

### 5.8.15 Use of Thimbles:

(a) Vent connectors made of single-wall metal pipe shall not pass through any combustible walls unless they are guarded at the point of passage by ventilated metal thimbles not smaller than the following:

1. For listed gas appliances equipped with draft hoods and gas appliances listed for use with Type B gas vents, except incinerators—4 inches larger in diameter than the vent connector, unless there is a run of not less than 6 feet of vent connector in the open, between the draft hood outlet and the thimble, in which case the thimble may be 2 inches larger in diameter than the vent connector.
2. For unlisted gas appliances having draft hoods—6 inches larger in diameter than the vent connector.
3. For incinerators and all other appliances—12 inches larger in diameter than the vent connector.

(b) In lieu of thimble protection, all combustible material in the wall shall be cut away from the vent connector a sufficient distance to provide the specified clearance from such vent connector to combustible material. Any material used to close up such opening shall be noncombustible.

## *5.9 SPECIAL VENTING ARRANGEMENTS*

### 5.9.1 Appliances With Sealed Combustion Systems:

(a) The provisions of draft hoods as shown in Part 3 and Sec-

tions 5.3 through 5.8, inclusive, do not apply to listed appliances having sealed combustion systems constructed and installed so that all air for combustion is derived from the outside atmosphere and all flue gases are discharged to the outside atmosphere. Such appliances, having integral venting, shall be considered as being properly vented when they are installed in accordance with their listing, the manufacturer's instructions and 5.9.1(b).

(b) Vent terminals of sealed combustion system appliances shall be located not less than 9 inches from any opening through which combustion products could enter the building. A sealed combustion system appliance may be installed in a building opening, such as a window. The bottom of the vent terminal and the air intake shall be located at least 12 inches above grade.

### 5.9.2 Appliances With Integral Vents:

(a) Appliances incorporating integral venting means shall be considered properly vented when installed in accordance with their listings and the manufacturer's instructions.

(b) Vent terminals of appliances using natural draft venting shall be located not less than 9 inches from any opening through which combustion products could enter the building. Vent terminals of appliances using forced draft venting shall be located not less than 12 inches from any opening through which combustion products could enter the building.

### 5.9.3 Mechanical Draft Systems:

(a) Appliances, except incinerators, requiring venting may also be vented by means of mechanical draft systems of either forced or induced draft design.

(b) Forced draft systems and all portions of induced draft systems under positive pressure during operation shall be designed and installed so as to be gastight or as to prevent leakage of combustion products into a building.

(c) Vent connectors serving gas appliances vented by natural draft shall not be connected into any portion of a mechanical draft system operating under positive pressure.

(d) When a mechanical draft system is employed, provision shall be made to prevent the flow of gas to the main burners when the draft system is not performing so as to satisfy the operating requirements of the appliance for safe performance.

(e) The exit terminals of mechanical draft systems shall be located not less than 12 inches from any opening through which

combustion products could enter the building nor less than 2 feet from an adjacent building, and not less than 7 feet above grade when located adjacent to public walkways.

### 5.9.4 Ventilating Hoods and Exhaust Systems:*

(a) Ventilating hoods and exhaust systems may be used to vent gas-burning appliances installed in commercial applications.

(b) When automatically operated appliances, such as water heaters, are vented through natural draft ventilating hoods, dampers shall not be installed in the ventilating system. When the ventilating hood or exhaust system is equipped with power means of exhaust, the appliance control system shall be interlocked so as to permit appliance operation only when the power means of exhaust is in operation, except as provided in 5.1.2(g).

*Information on the construction and installation of ventilating hoods may be obtained from NFPA No. 96, Standard on Vapor Removal from Cooking Equipment, available from the National Fire Protection Association, 60 Batterymarch St., Boston, Mass. 02110.

# Part 6 — Procedures to be Followed to Place an Appliance in Operation

## 6.1 *ADJUSTING THE BURNER INPUT*

### 6.1.1 Burner Input:

Each burner shall be adjusted to its proper input in accordance with the manufacturer's instructions. Over-rating of burners is prohibited.

### 6.1.2 High Altitude:

Ratings of gas appliances are based on sea level operation and need not be changed for operation at elevations up to 2,000 feet. For operation at elevations above 2,000 feet, appliance ratings should be reduced at the rate of 4 percent for each 1,000 feet above sea level before selecting an appropriately sized gas appliance.

### 6.1.3 Checking Burner Input:

(a) *Checking Burner Input Using a Meter*

To check the Btu input rate, the test hand on the meter should be timed for at least one revolution and the input determined from this timing. Test dials are generally marked ½, 1, 2 or 5 cubic feet per revolution depending upon the size of the meter. Instructions for converting the test hand readings to cubic feet per hour are given in Table 11.

(b) *Checking Burner Input Not Using a Meter.*

The fixed orifice size for each burner may be determined in accordance with Table 1 for utility gases and Table 2 for undiluted liquefied petroleum gases in Appendix C.

### 6.1.4 Adjusting Input:

The input rate shall be adjusted to the proper rate by changing a fixed orifice size, changing the adjustment of an adjustable orifice, or by readjustment of the gas pressure regulator outlet pressure (when a regulator is provided) within limitations authorized by the serving gas supplier.

## 6.2 *PRIMARY AIR ADJUSTMENT*

The primary air for injection (Bunsen) type burners shall be adjusted for proper flame characteristics in accordance with the manufacturer's instructions. Normally, the primary air adjustment should first be set to give a soft blue flame having luminous tips and then increased to a point where the yellow tips just disappear.

*Continued on page 54 - 96*

**Table 11**

**Gas Input to Burner in Cubic Feet Per Hour**

| Seconds For One Revolution | Size of Test Meter Dial: One-Half Cu. Ft. | One Cu. Ft. | Two Cu. Ft. | Five Cu. Ft. |
|---|---|---|---|---|
| | Cubic Feet Per Hour | | | |
| 10 | 180 | 360 | 720 | 1,800 |
| 11 | 164 | 327 | 655 | 1,636 |
| 12 | 150 | 300 | 600 | 1,500 |
| 13 | 138 | 277 | 555 | 1,385 |
| 14 | 129 | 257 | 514 | 1,286 |
| 15 | 120 | 240 | 480 | 1,200 |
| 16 | 112 | 225 | 450 | 1,125 |
| 17 | 106 | 212 | 424 | 1,059 |
| 18 | 100 | 200 | 400 | 1,000 |
| 19 | 95 | 189 | 379 | 947 |
| 20 | 90 | 180 | 360 | 900 |
| 21 | 86 | 171 | 343 | 857 |
| 22 | 82 | 164 | 327 | 818 |
| 23 | 78 | 157 | 313 | 783 |
| 24 | 75 | 150 | 300 | 750 |
| 25 | 72 | 144 | 288 | 720 |
| 26 | 69 | 138 | 277 | 692 |
| 27 | 67 | 133 | 267 | 667 |
| 28 | 64 | 129 | 257 | 643 |
| 29 | 62 | 124 | 248 | 621 |
| 30 | 60 | 120 | 240 | 600 |
| 31 | 58 | 116 | 232 | 581 |
| 32 | 56 | 113 | 225 | 563 |
| 33 | 55 | 109 | 218 | 545 |
| 34 | 53 | 106 | 212 | 529 |
| 35 | 51 | 103 | 206 | 514 |
| 36 | 50 | 100 | 200 | 500 |
| 37 | 49 | 97 | 195 | 486 |
| 38 | 47 | 95 | 189 | 474 |
| 39 | 46 | 92 | 185 | 462 |
| 40 | 45 | 90 | 180 | 450 |
| 41 | 44 | 88 | 176 | 440 |
| 42 | 43 | 86 | 172 | 430 |
| 43 | 42 | 84 | 167 | 420 |
| 44 | 41 | 82 | 164 | 410 |
| 45 | 40 | 80 | 160 | 400 |
| 46 | 39 | 78 | 157 | 391 |
| 47 | 38 | 77 | 153 | 383 |
| 48 | 37 | 75 | 150 | 375 |
| 49 | 37 | 73 | 147 | 367 |

**NOTE: To convert to Btu per hour multiply by the Btu heating value of the gas used.**

**Table 11 (Continued)**

**Gas Input to Burner in Cubic Feet Per Hour**

| Seconds For One Revolution | Size of Test Meter Dial: One-Half Cu. Ft. | One Cu. Ft. | Two Cu. Ft. | Five Cu. Ft. |
|---|---|---|---|---|
| | Cubic Feet Per Hour | | | |
| 50 | 36 | 72 | 144 | 360 |
| 51 | 35 | 71 | 141 | 353 |
| 52 | 35 | 69 | 138 | 346 |
| 53 | 34 | 68 | 136 | 340 |
| 54 | 33 | 67 | 133 | 333 |
| 55 | 33 | 65 | 131 | 327 |
| 56 | 32 | 64 | 129 | 321 |
| 57 | 32 | 63 | 126 | 316 |
| 58 | 31 | 62 | 124 | 310 |
| 59 | 30 | 61 | 122 | 305 |
| 60 | 30 | 60 | 120 | 300 |
| 62 | 29 | 58 | 116 | 290 |
| 64 | 29 | 56 | 112 | 281 |
| 66 | 29 | 54 | 109 | 273 |
| 68 | 28 | 53 | 106 | 265 |
| 70 | 26 | 51 | 103 | 257 |
| 72 | 25 | 50 | 100 | 250 |
| 74 | 24 | 48 | 97 | 243 |
| 76 | 24 | 47 | 95 | 237 |
| 78 | 23 | 46 | 92 | 231 |
| 80 | 22 | 45 | 90 | 225 |
| 82 | 22 | 44 | 88 | 220 |
| 84 | 21 | 43 | 86 | 214 |
| 86 | 21 | 42 | 84 | 209 |
| 88 | 20 | 41 | 82 | 205 |
| 90 | 20 | 40 | 80 | 200 |
| 94 | 19 | 38 | 76 | 192 |
| 98 | 18 | 37 | 74 | 184 |
| 100 | 18 | 36 | 72 | 180 |
| 104 | 17 | 35 | 69 | 173 |
| 108 | 17 | 33 | 67 | 167 |
| 112 | 16 | 32 | 64 | 161 |
| 116 | 15 | 31 | 62 | 155 |
| 120 | 15 | 30 | 60 | 150 |
| 130 | 14 | 28 | 55 | 138 |
| 140 | 13 | 26 | 51 | 129 |
| 150 | 12 | 24 | 48 | 120 |
| 160 | 11 | 22 | 45 | 112 |
| 170 | 11 | 21 | 42 | 106 |
| 180 | 10 | 20 | 40 | 100 |

**NOTE: To convert to Btu per hour multiply by the Btu heating value of the gas used.**

If the burner cannot be adjusted as above, consult the manufacturer or serving gas supplier. After setting the primary air, the adjustment means shall be secured in position.

### 6.3 *SAFETY SHUTOFF DEVICES*

When a safety shutoff device is provided, it shall be checked for proper operation and adjustment in accordance with the manufacturer's instructions. If the device does not function properly to turn off the gas supply in the event of pilot outage, it shall be properly serviced or replaced with new equipment.

### 6.4 *AUTOMATIC IGNITION*

Appliances equipped with means for automatic ignition, such as used with domestic gas range top burners, shall be checked for proper operation. If necessary, proper adjustments shall be made.

### 6.5 *PROTECTIVE DEVICES*

All protective devices furnished with the appliance, such as a limit control, fan control to blower, temperature and pressure relief valve, low water cut-off device, manual operating features, etc., shall be checked for proper operation.

### 6.6 *CHECKING THE DRAFT*

Vent connected appliances shall be operated for a few minutes and checked to see that the products of combustion are going up the chimney or gas vent properly by passing a lighted match or taper around the edge of the relief opening of the draft hood. If the chimney or gas vent is drawing properly, the match flame will be drawn into the draft hood. If not, the products of combustion will tend to extinguish this flame. If the products of combustion are escaping from the relief opening of the draft hood, the appliance shall not be operated until proper adjustment or repairs are made to provide adequate draft through the chimney or gas vent.

### 6.7 *OPERATING INSTRUCTIONS*

**6.7.1** The consumer should know how to operate the appliance safely.

**6.7.2** When operating instructions are furnished by the manufacturer, they shall be left in a prominent position near the appliance.

### 6.8 *NOTIFICATION OF COMPLETION*

When regulations so require, the serving gas supplier or the authority having jurisdiction shall be notified that the installation has been completed.

# Part 7 — Definitions

AIR CONDITIONING. The treatment of air so as to control simultaneously its temperature, humidity, cleanness and distribution to meet the requirements of a conditioned space.

AIR MIXER. That portion of an injection (Bunsen) type burner into which the primary air is introduced.

AIR SHUTTER. An adjustable device for varying the size of the primary air inlet(s).

APPLIANCE. A gas appliance is any device which utilizes gas to produce light, heat, power, refrigeration, or air conditioning.

APPLIANCE—AUTOMATICALLY CONTROLLED. Appliances equipped with an automatic burner ignition and safety shutoff device and other automatic devices which:

(a) Accomplish complete turn-on and shutoff of the gas to the main burner or burners.

(b) Graduate the gas supply to the burner or burners, but do not effect complete shutoff of the gas.

APPLIANCE FLUE. The flue passages within the appliance.

APPROVED. Acceptable to the authority having jurisdiction.

AUTOMATIC GAS SHUTOFF DEVICE. A device constructed so that the attainment of a water temperature in a hot water supply system in excess of some predetermined limit acts in such a way as to cause the gas to the system to be shut off.

AUTOMATIC IGNITION. Ignition of gas at the burner(s) when the gas controlling device is turned on, including reignition if the flames on the burner(s) have been extinguished by means other than by the closing of the gas controlling device.

AUTOMATIC PILOT. (See Safety Shutoff Device.)

BAFFLE. An object placed in an appliance to change the direction of, or retard, the flow of air, air-gas mixtures, or flue gases.

BOILER. A self-contained, gas-burning appliance for supplying hot water or low-pressure steam, primarily intended for domestic and commercial space heating application.

BRANCH LINE. Gas piping which conveys gas from a supply line to the appliance.

BROILER. A general term including broilers, salamanders, barbecues, and other devices cooking primarily by radiated heat, excepting toasters.

BTU. Abbreviation for British Thermal Unit which is the quantity

of heat required to raise the temperature of one pound of water one degree Fahrenheit.

BUILT-IN DOMESTIC COOKING UNIT. (See Range, Built-In Domestic Cooking Unit.)

BUNGALOW (UTILITY) TYPE DOMESTIC GAS RANGE. (See Range, Domestic Bungalow.)

BURNER. A device for the final conveyance of the gas, or a mixture of gas and air, to the combustion zone.

(a) *Injection (Bunsen) Type Burner.* A burner employing the energy of a jet of gas to inject air for combustion into the burner and mix it with the gas.

1. Atmospheric Injection Type Burner. A burner in which the air at atmospheric pressure is injected into the burner by a jet of gas.

(b) *Luminous or Yellow Flame Burner.* A burner in which secondary air only is depended on for the combustion of the gas.

(c) *Power Burner.* A burner in which either gas or air or both are supplied at pressures exceeding, for gas, the line pressure, and for air, atmospheric pressure; this added pressure being applied at the burner.

1. Premixing Burner. A power burner in which all or nearly all of the air for combustion is mixed with the gas as primary air.

(d) *Pressure Burner.* A burner which is supplied with an air-gas mixture under pressure (usually from 0.5 to 14 inches of water and occasionally higher).

CHIMNEY. (ALSO SEE GAS VENTS.) A vertical shaft enclosing one or more flues for conveying flue gases to the outside atmosphere.

(a) *Factory-Built Chimney.* A listed chimney.

(b) *Masonry Chimney.* A chimney of solid masonry units, bricks, stones, listed masonry units or reinforced concrete, lined with suitable flue liners.

(c) *Metal Chimney.* A field-constructed chimney of metal.

CLOSED WATER PIPING SYSTEM. A system of water piping where a check valve or other device prevents the free return of water or steam to the water main.

CLOTHES DRYER. A device used to dry wet laundry by means of heat derived from the combustion of fuel gases. Dryer classifications are as follows:

(a) *Type 1.* Factory-built package, multiple produced. Primarily used in family living environment. May or may not be coin-operated for public use. Usually the smallest unit physically and in function output.

(b) *Type 2.* Factory-built package, multiple produced. Used in business with direct intercourse of the function with the public. May or

may not be operated by public or hired attendant. May or may not be coin operated. Not designed for use in individual family living environment. May be small, medium or large in relative size.

COMBUSTIBLE MATERIAL. As pertaining to materials adjacent to or in contact with heat producing appliances, vent connectors, gas vents, chimneys, steam and hot water pipes, and warm air ducts, shall mean materials made of or surfaced with wood, compressed paper, plant fibers, or other materials that will ignite and burn. Such material shall be considered combustible even though flame-proofed, fire retardant treated, or plastered.

COMBUSTION. Combustion, as used herein, refers to the rapid oxidation of fuel gases accompanied by the production of heat, or heat and light. Complete combustion of a fuel is possible only in the presence of an adequate supply of oxygen.

COMBUSTION CHAMBER. The portion of an appliance within which combustion occurs.

COMBUSTION PRODUCTS. Constituents resulting from the combustion of a fuel with the oxygen of the air, including the inerts but excluding excess air.

COMMERCIAL BAKING AND ROASTING OVEN. An oven that can be moved from place to place as a unit. It may be composed of one or more sections or units and may be of the following types:

(a) *Cabinet Oven.* A stationary deck oven having more than one deck heated by a single burner or group of burners.

(b) *Sectional Oven.* A single stationary deck oven or one composed of one or more independently heated stationary decks.

(c) *Reel-Type Oven.* A single oven employing trays that are moved by mechanical means.

CONCEALED GAS PIPING. Gas piping, which, when in place in the finished building, would require removal of permanent construction to gain access to the piping.

CONDENSATE—(CONDENSATION). The liquid which separates from a gas (including flue gas) due to a reduction in temperature.

CONTROLS. Devices designed to regulate the gas, air, water or electrical supply to a gas appliance. These may be manual or automatic.

CONVERSION BURNER. A burner designed to supply gaseous fuel to an appliance originally designed to utilize another fuel.

(a) *Firing Door Type.* A conversion burner designed specifically for boiler or furnace firing door installation.

(b) *In-Shot Type.* A conversion burner normally designed for boiler or furnace ash pit installation and fired in a horizontal position.

(c) *Up-Shot Type.* A conversion burner normally designed for boiler or furnace ash pit installation and fired in a vertical position at approximately grate level.

COUNTER APPLIANCES, GAS. Appliances such as gas-operated coffee brewers and coffee urns and any appurtenant water heating equipment, food and dish warmers, hot plates and griddles.

CUBIC FOOT (CU. FT.) OF GAS. The amount of gas which would occupy 1 cubic foot when at a temperature of 60° F, saturated with water vapor and under a pressure equivalent to that of 30 inches of mercury.

DEEP FAT FRYER, HOTEL AND RESTAURANT. An appliance including a cooking vessel in which oils or fats are placed to such a depth that the cooking food is essentially supported by displacement of the cooking fluid or a perforated container immersed in the cooking fluid rather than by the bottom of the vessel, designed primarily for use in hotels, restaurants, clubs, and similar institutions.

DEMAND. The maximum amount of gas required per unit of time, usually expressed in cubic feet per hour, or Btu per hour, required for the operation of the appliance or appliances supplied.

DILUTION AIR. Air which enters a draft hood or draft regulator and mixes with the flue gases.

DIRECT-FIRED OVEN. A direct-fired oven is one in which the flue gases flow through the oven compartment.

DIVERSITY FACTOR. Ratio of the maximum probable demand to the maximum possible demand.

DRAFT HOOD. A device built into an appliance, or made a part of the vent connector from an appliance, which is designed to (1) provide for the ready escape of the flue gases in the event of no draft, back draft, or stoppage beyond the draft hood; (2) prevent a back draft from entering the appliance; and (3) neutralize the effect of stack action of the chimney or gas vent upon the operation of the appliance.

DRAFT REGULATOR. A device which functions to maintain a desired draft in the appliance by automatically reducing the draft to the desired value.

DRIP. The container placed at a low point in a system of piping to collect condensate and from which it may be removed.

DRY GAS. A gas having a moisture and hydrocarbon dew point below any normal temperature to which the gas piping is exposed.

DUCT FURNACE. A furnace normally installed in distribution ducts of air conditioning systems to supply warm air for heating. This definition shall apply only to an appliance which depends for air circulation on a blower not furnished as part of the furnace.

EXCESS AIR. Air which passes through the combustion chamber and the appliance flues in excess of that which is theoretically required for complete combustion.

EXPOSED PIPING. Gas piping which will be in view in the finished structure.

FLAMES.

(a) *Yellow, Luminous or Non-Bunsen.* The flame produced by burning gas without any premixing of air with the gas.

(b) *Bunsen.* The flame produced by premixing some of the air required for combustion with the gas before it reaches the burner ports or point of ignition.

FLOOR FURNACE. A completely self-contained unit furnace suspended from the floor of the space being heated, taking air for combustion from outside this space, and with means for observing flames and lighting the appliance from such space.

(a) *Gravity Type Floor Furnace.* A floor furnace depending primarily upon circulation of air by gravity. This classification shall also include floor furnaces equipped with booster type fans which do not materially restrict free circulation of air by gravity flow when such fans are not in operation.

(b) *Fan Type Floor Furnace.* A floor furnace equipped with a fan which provides the primary means for circulation of air.

FLUE COLLAR. That portion of an appliance designed for the attachment of the draft hood or vent connector.

FLUE EXHAUSTER. A device installed in and made a part of the vent which will provide a positive induced draft.

FLUE GASES. Products of combustion plus excess air in appliance flues or heat exchangers (before the draft hood or draft regulator).

FURNACE — CENTRAL FURNACE. A self-contained, gas-burning appliance for heating air by transfer of heat of combustion through metal to the air, and designed to supply heated air through ducts to spaces remote from or adjacent to the appliance location.

(a) *Gravity Type Central Furnace.* A central furnace depending primarily on circulation of air by gravity.

(b) *Gravity Type Central Furnace With Integral Fan.* A central furnace equipped with a fan or blower as an integral part of its construction and operable on gravity systems only. The fan or blower is to be used only to overcome the internal resistance to air flow.

(c) *Gravity Type Central Furnace With Booster Fan.* A central furnace equipped with a booster fan which does not materially restrict free circulation of air by gravity flow when such fans are not in operation.

(d) *Forced Air Type Central Furnace.* A central furnace equipped with a fan or blower which provides the primary means for circulation of air.

1. Horizontal Type Central Furnace. A furnace designed for low headroom installation with air flow through the appliance essentially in a horizontal path.

2. Upflow Type Central Furnace. A furnace designed with air flow essentially in a vertical path, discharging air at or near the top of the furnace.

3. Downflow Type Central Furnace. A furnace designed with air flow essentially in a vertical path, discharging air at or near the bottom of the furnace.

GARAGE, RESIDENTIAL. A building or room in which not more than three self-propelled passenger vehicles are or may be stored, and which will not normally be used for other than minor service or repair operations on such stored vehicles.

GAS PIPING SYSTEM. Piping from the meter or service regulator when a meter is not provided to an appliance or appliances.

GAS VENTS. Factory-built vent piping and vent fittings listed by a nationally recognized testing agency, that are assembled and used in accordance with the terms of their listings, for conveying flue gases to the outside atmosphere.

(a) *Type B Gas Vent.* A gas vent for venting gas appliances with draft hoods and other gas appliances listed for use with Type B Gas Vents.

(b) *Type BW Gas Vent.* A gas vent for venting listed gas-fired vented wall furnaces.

GRAVITY. (See Specific Gravity.)

HEATING VALUE (TOTAL). The number of British Thermal Units produced by the combustion at constant pressure, of 1 cubic foot of gas when the products of combustion are cooled to the initial temperature of the gas and air, when the water vapor formed during combustion is condensed, and when all the necessary corrections have been applied.

HOT PLATE, COMMERCIAL (See Counter Appliances, Gas.)

HOT PLATE, DOMESTIC. A gas-burning appliance consisting of one or more open-top type burners mounted on short legs or a base.

HOTEL AND RESTAURANT RANGE. A self-contained gas range providing for cooking, roasting, baking or broiling, or any combination of these functions, and not designed specifically for domestic use.

INCINERATOR, DOMESTIC GAS-FIRED. A domestic appliance used to reduce combustible refuse material to ashes and which is manufactured, sold and installed as a complete unit.

INDIRECT OVEN. An indirect oven is one in which the flue gases do not flow through the oven compartment.

INFRARED RADIANT HEATER. A heater which directs a substantial amount of its energy output in the form of infrared radiant energy into the area to be heated. Such heaters may be of either the vented or unvented type.

JOINT, ADHESIVE. A joint made in plastic piping by the use of an adhesive substance which forms a continuous bond between the mating surfaces without dissolving either one of them.

JOINT, HEAT FUSION. A joint made in thermoplastic piping by heating the parts sufficiently to permit fusion of the materials when the parts are pressed together.

JOINT, SOLVENT CEMENT. A joint made in thermoplastic piping by the use of a solvent or solvent cement which forms a continuous bond between the mating surfaces.

KETTLE, GAS-FIRED. An appliance with a cooking chamber which is heated either by a steam jacket in which steam is generated by gas heat or by direct gas heat applied to the cooking chamber.

LABELED. Equipment or materials to which has been attached a label of a nationally recognized testing laboratory that maintains periodic inspection of production of labeled equipment or materials and by whose labeling is indicated compliance with nationally recognized standards or the conduct of tests to determine suitable usage in a specified manner.

LAUNDRY STOVE, DOMESTIC. A gas-burning appliance consisting of one or more open-top type burners mounted on high legs or having a cabinet base.

LIMIT CONTROL. A device responsive to changes in pressure or temperature or liquid level for turning on, shutting off, or throttling the gas supply to an appliance.

LISTED. Equipment or materials included in a list published by a nationally recognized testing laboratory that maintains periodic inspection of production of listed equipment or materials and whose listing states either that the equipment or material meets nationally recognized standards or has been tested and found suitable for use in a specified manner.

MAIN BURNER. A device or group of devices essentially forming an integral unit for the final conveyance of gas or a mixture of gas and air to the combustion zone, and on which combustion takes place to accomplish the function for which the appliance is designed.

MANIFOLD GAS. The conduit of an appliance which supplies gas to the individual burners.

MEASURED GAS. Gas which has passed through and the volume of

which has been measured by a meter, or gas which has been otherwise measured such as by liquid volume or weight.

METER. An instrument installed to measure the volume of gas delivered through it.

METER SET ASSEMBLY. The piping and fittings installed by the serving gas supplier to connect the inlet side of the meter to the gas service and to connect the outlet side of the meter to the customer's house or yard piping.

MIXER. The combination of mixer head, mixer throat and mixer tube.

(a) *Mixer Head.* The portion of an injection (Bunsen) type burner, usually enlarged, into which primary air flows to mix with the gas stream.

(b) *Mixer Throat.* The portion of the mixer which has the smallest cross-sectional area and which lies between the mixer head and the mixer tube.

(c) *Mixer Tube.* The portion of the mixer which lies between the throat and the burner head.

MIXER FACE. The air inlet end of the mixer head.

ORIFICE. The opening in a cap, spud or other device whereby the flow of gas is limited and through which the gas is discharged to the burner.

ORIFICE CAP (HOOD). A movable fitting having an orifice which permits adjustment of the flow of gas by the changing of its position with respect to a fixed needle or other device.

ORIFICE SPUD. A removable plug or cap containing an orifice which permits adjustment of the flow of gas either by substitution of a spud with a different sized orifice or by the motion of a needle with respect to it.

PILOT. A small flame which is utilized to ignite the gas at the main burner or burners.

PIPING. Where the word piping is used in these standards, it refers to either pipe or tubing, or both.

(a) *Pipe.* Refers to a rigid conduit of iron, steel, copper, brass, aluminum, or plastic.

(b) *Tubing.* Refers to a semirigid conduit of copper, steel, aluminum, or plastic.

PLASTIC.

(a) *Thermoplastic.* A plastic which is capable of being repeatedly softened by increase of temperature and hardened by decrease of temperature.

(b) *Thermosetting.* A plastic which is capable of being changed into a substantially infusible or insoluble product when cured under application of heat or chemical means.

PRESSURE REGULATOR SERVICE. A device designed to reduce and limit the gas pressure to domestic and commercial customers when the pressure of the supply system is in excess of ½ pound per square inch or 14 inches water column.

PRIMARY AIR. The air introduced into a burner which mixes with the gas before it reaches the port or ports.

PURGE. To free a gas conduit of air, or gas, or a mixture of gas and air.

QUICK-DISCONNECT DEVICE. A hand-operated device which provides a means for connecting and disconnecting an appliance or an appliance connector to a gas supply and which is equipped with an automatic means to shut off the gas supply when the device is disconnected.

RANGE, BUILT-IN DOMESTIC COOKING UNIT. A gas appliance for domestic food preparation, providing at least one function of (1) top or surface cooking, (2) oven cooking, (3) broiling, and designed to be recessed into, placed upon, or attached to counters, cabinets, walls or partitions.

RANGE, DOMESTIC BUNGALOW. (UTILITY TYPE.) A domestic range having a gas oven and top section, and a gas, solid or liquid fuel section designed for space heating and heating a solid top section but not for oven heating.

RANGE, DOMESTIC GAS. A self-contained, free standing, gas burning appliance designed for domestic cooking purposes and having a top section and an oven section. It may have a broiling section.

RANGE, DOMESTIC GAS ROOM HEATER TYPE. A domestic gas range having a gas oven and top section, and a separate room heater section designed for gas fuel.

REFRIGERATOR (USING GAS FUEL). A gas-burning appliance which is designed to extract heat from a suitable chamber.

REGULATOR, GAS PRESSURE. A device, either adjustable, nonadjustable or convertible, for controlling and maintaining a uniform outlet gas pressure.

(a) Adjustable

1. *Spring Type, Standard Adjustment.* A regulator in which the regulating force acting upon the diaphragm is derived principally from a spring, the loading of which is adjustable.

2. *Spring Type, Limited Adjustment.* A regulator in which the regulating force acting upon the diaphragm is derived principally from a spring, the loading of which is adjustable over a range of not more than 1.0 inch water outlet pressure.

(b) Nonadjustable

1. *Spring Type, Nonadjustable.* A regulator in which the regulat-

ing force acting upon the diaphragm is derived principally from a spring, the loading of which is not adjustable.

2. *Weight Type.* A regulator in which the regulating force acting upon the diaphragm is derived from a weight or combination of weights.

(c) Convertible

A regulator whose adjustment means can be positioned from one predetermined outlet pressure setting to another predetermined outlet pressure setting with no intermediate pressure settings and without addition, deletion, or substitution of parts.

RELIEF OPENING. The opening provided in a draft hood to permit the ready escape to the atmosphere of the flue products from the draft hood in the event of no draft, back draft, or stoppage beyond the draft hood, and to permit inspiration of air into the draft hood in the event of a strong chimney updraft.

ROOM HEATER, UNVENTED. An unvented, self-contained, free standing, nonrecessed (except as noted under "g" and "h" of the following classifications), gas-burning appliance for furnishing warm air by gravity or fan circulation to the space in which installed directly from the heater without duct connection. Unvented room heaters shall not have a normal input rating in excess of 50,000 Btu per hour, except as noted under "g" and "h" of the following classifications.

(a) *Unvented Circulator.* A room heater designed to convert the energy in fuel gas to convected and radiant heat by direct mixing of air to be heated with the combustion products and excess air inside the jacket. Unvented circulators have an external jacket surrounding the burner and may be equipped with radiants with the jacket open in front of the radiants.

(b) *Coal Basket.* An unvented, open-flame type room heater consisting of a metal basket filled with simulated coals which gives the appearance of a coal fire when in operation. A coal basket is for installation in a fireplace.

(c) *Fireplace Insert.* Consists of an unvented open-flame radiant-type heater mounted in a decorative metal panel to cover the fireplace or mantel opening.

(d) *Gas Log.* An unvented, open-flame type room heater consisting of a metal frame or base supporting simulated logs. A gas log is for installation in a fireplace.

(e) *Radiant Heater.* An unvented room heater designed primarily to convert the energy in fuel gas to radiant heat by means of refractory radiants or similar radiating materials. A radiant heater has no external jacket, but is equipped with an exposed back wall.

(f) *Unvented Overhead Heater.* An unvented room heater for suspension from the ceiling in the room being heated.

(g) *Wall Heater, Unvented, Open-Flame, Radiant Type.* An unvented room heater of the open-front type, for insertion in or attachment to a wall or partition, having exposed flames, the heat from which is reflected by fireclay or similar radiating materials. It shall not have a normal input rating in excess of 25,000 Btu per hour.

(h) *Wall Heater, Unvented Closed Front.* An unvented circulator having a closed front, for insertion in or attachment to a wall or partition. These heaters shall be plainly marked, "UNVENTED HEATERS" in letters ½ inch high and shall not have a normal input rating in excess of 25,000 Btu per hour.

ROOM HEATER, VENTED. A vented, self-contained, free standing, nonrecessed, gas-burning appliance for furnishing warm air to the space in which installed, directly from the heater without duct connections.

(a) *Vented Circulator.* A room heater designed to convert the energy in fuel gas to convected and radiant heat, by transfer of heat from flue gases to a heat exchanger surface, without mixing of flue gases with circulating heated air. Vented circulators may be equipped with transparent panels and radiating surfaces to increase radiant heat transfer as long as separation of flue gases from circulating air is maintained. Vented circulators may also be equipped with an optional circulating air fan, but shall perform satisfactorily with or without the fan in operation.

(b) *Fan Type Vented Circulator.* A vented circulator equipped with an integral circulating air fan, the operation of which is necessary for satisfactory appliance performance.

(c) *Vented Overhead Heater.* A room heater designed for suspension from or attachment to or adjacent to the ceiling of the room being heated and transferring the energy of the fuel gas to the space being heated primarily by radiation downward from a hot surface, and in which there is no mixing of flue gases with the air of the space being heated.

SAFETY SHUTOFF DEVICE. A device that will shut off the gas supply to the controlled burner(s) in the event the source of ignition fails. This device may interrupt the flow of gas to main burner(s) only, or to pilot(s) and main burner(s) under its supervision.

SEALED COMBUSTION SYSTEM APPLIANCES. Appliances which are constructed and installed so that all air for combustion is derived from the outside atmosphere and all flue gases are discharged to the outside atmosphere.

SECONDARY AIR. The air externally supplied to the flame at the point of combustion.

SERVICE PIPE. The pipe which brings the gas from the gas main to the meter.

SERVICE REGULATOR. (See Pressure Regulator, Service.)

SHUT-OFF. (See Valve.)

SPECIFIC GRAVITY. As applied to gas, specific gravity is the ratio of the weight of a given volume to that of the same volume of air, both measured under the same conditions.

STEAM COOKER. A gas-fired appliance which cooks, defrosts or reconstitutes food by direct contact with steam.

STEAM GENERATOR. A separate appliance primarily intended to supply steam for use with commercial cooking equipment.

THERMOSTAT, ELECTRIC SWITCH TYPE. A device which senses changes in temperature and controls electrically, by means of separate components, the flow of gas to the burners to maintain selected temperatures.

THERMOSTAT, INTEGRAL GAS VALVE TYPE. An automatic device actuated by temperature changes designed to control the gas supply to the burners in order to maintain temperatures between predetermined limits, and in which the thermal actuating element is an integral part of the device.

(a) *Graduating Thermostat.* A thermostat in which the motion of the valve is approximately in direct proportion to the effective motion of the thermal element induced by temperature change.

(b) *Snap-Acting Thermostat.* A thermostat in which the thermostatic valve travels instantly from the closed to the open position, and vice versa.

TYPE B GAS VENT. (See Gas Vents.)

TYPE BW GAS VENT. (See Gas Vents.)

TYPE L VENTING SYSTEM. A venting system composed of listed factory-built components assembled in accordance with the terms of listing for venting appliances listed for use with Type L venting systems. They may be used also where Type B gas vents are permitted.

UNIT BROILER. A broiler constructed as a separate appliance.

UNIT HEATER.

(a) *Low Static Pressure Type.* A self-contained, automatically controlled, vented, gas-burning appliance. These appliances are intended for installation in the space to be heated unless designed for outdoor installation. Such appliances have integral means for circulation of air, normally by a propeller fan(s), and may be equipped with louvers or face extensions made in accordance with the manufacturer's specification.

(b) *High Static Pressure Type.* A self-contained, automatically controlled, vented, gas-burning appliance. These appliances have integral means for circulation of air against 0.2 inch or greater static pressure and are designed for installation in the space to be heated unless they are equipped with provisions for attaching both inlet and outlet air ducts or designed for outdoor installation.

UNMEASURED GAS. Gas which has not passed through and the vol-

ume of which has not been measured by a meter, or gas which has not otherwise been measured such as by liquid volume or weight.

UTILITY GASES. Natural gas, manufactured gas, liquefied petroleum gas-air mixtures, or mixtures of any of these gases.

VALVE. (Formerly "Control Cock.") A device used in piping to control the gas supply to any section of a system of piping or to an appliance.

VALVE, AUTOMATIC. (Formerly "Automatic Valve for Gas Appliances.") An automatic or semiautomatic device consisting essentially of a valve and operator that controls the gas supply to the burner(s) during operation of an appliance. The operator may be actuated by application of gas pressure on a flexible diaphragm, by electrical means, by mechanical means or by other means.

VALVE, AUTOMATIC GAS SHUTOFF. (Formerly "Automatic Gas Shutoff Valve.") A valve used in conjunction with an automatic gas shutoff device to shut off the gas supply to a gas-fired water heating system. It may be constructed integrally with the gas shutoff device, or be a separate assembly.

VALVE, INDIVIDUAL MAIN BURNER. (Formerly "Individual Main Burner Valve.") A valve which controls the gas supply to an individual main burner.

VALVE, MAIN BURNER CONTROL. (Formerly "Main Burner Control Valve.") A valve which controls the gas supply to the main burner manifold.

VALVE, MANUAL MAIN GAS-CONTROL. (Formerly "Manual Main Gas-Control Valve.") A manually operated valve in the gas line for the purpose of completely turning on or shutting off the gas supply to the appliance except to pilot or pilots which are provided with independent shutoff.

VALVE, RELIEF. (Formerly "Relief Valve.") A safety valve designed to forestall the development of a dangerous condition by relieving either pressure, temperature, or vacuum in the hot water supply system.

(a) *Pressure.* A valve which automatically opens and closes a relief vent, depending on whether the pressure is above or below a predetermined value.

(b) *Temperature.*

1. *Fusible Type.* A valve which opens and keeps open a relief vent by the melting or softening of a fusible element at a predetermined temperature.

2. *Resetting or Self-Closing Type.* A valve which automatically opens and closes a relief vent, depending on whether the temperature is above or below a predetermined value.

3. *Manual Reset Type.* A valve which automatically opens a relief

vent at a predetermined temperature and which must be manually returned to the closed position.

(c) *Vacuum.* A valve which automatically opens and closes a vent for relieving a vacuum within the hot water supply system depending on whether the vacuum is above or below a predetermined value.

VENT CONNECTOR. That portion of the venting system which connects the gas appliance to the gas vent, chimney or single-wall metal pipe.

VENTED DECORATIVE GAS APPLIANCE. A vented appliance whose only function lies in the aesthetic effect of the flames.

VENT GASES. Products of combustion from gas appliances plus excess air, plus dilution air in the venting system above the draft hood or draft regulator.

VENTED WALL FURNACE. A self-contained, vented appliance complete with grilles or equivalent, designed for incorporation in or permanent attachment to the structure of a building, mobile home or travel trailer, and furnishing heated air circulated by gravity or by a fan directly into the space to be heated through openings in the casing. Such appliances shall not be provided with duct extensions beyond the vertical and horizontal limits of the casing proper, except that boots not to exceed 10 inches beyond the horizontal limits of the casing for extension through walls of nominal thickness may be permitted. When such boots are provided they shall be supplied by the manufacturer as an integral part of the appliance. This definition excludes floor furnaces, unit heaters, sealed combustion system wall furnaces and central furnaces.

(a) *Gravity Type Vented Wall Furnace.* A wall furnace depending on circulation of air by gravity.

(b) *Fan Type Vented Wall Furnace.* A wall furnace equipped with a fan.

VENTING SYSTEM. The gas vent, chimney or single-wall metal pipe, and vent connector if used, assembled to form a continuous open passageway from the gas appliance to the outside atmosphere for the purpose of removing vent gases.

WATER HEATER. An appliance for supplying hot water for domestic or commercial purposes other than for space heating.

(a) *Circulating Heaters*

1. *Automatic Circulating Tank Type Heater.* A water heater which furnishes hot water to be stored in a separate vessel. Storage tank temperatures are controlled by means of a thermostat installed on the water heater. Circulation may be either gravity or forced.

2. *Nonautomatic Circulating Tank Type Heater.* A water heater which furnishes hot water to be stored in a separate vessel. Storage