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# LIQUEFIED PETROLEUM GAS PIPING AND APPLIANCE INSTALLATIONS IN BUILDINGS

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NATIONAL FIRE PROTECTION ASSOCIATION
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# NATIONAL FIRE PROTECTION ASSOCIATION

INTERNATIONAL

Executive Office: 60 Batterymarch St., Boston 10, Mass.

The National Fire Protection Association was organized in 1896 to promote the science and improve the methods of fire protection and prevention, to obtain and circulate information on these subjects and to secure the cooperation of its members in establishing proper safeguards against loss of life and property by fire. Its membership includes over a hundred and eighty national and regional societies and associations and nearly fifteen thousand individuals, corporations, and organizations.

This pamphlet is one of a large number of publications on fire safety issued by the Association; a complete list is available without charge on request. The standards, prepared by the technical committees of the National Fire Protection Association and adopted in the annual meetings of the Association, are intended to prescribe reasonable measures for minimizing fire losses. All interests concerned have opportunity through the National Fire Protection Association to participate in the development of the standards and to secure impartial consideration of matters affecting them.

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These recommended good practice rules were first submitted to the NFPA by the Committe on Gases in May 1951 and were tentatively adopted. They were finally adopted at the NFPA Annual Meeting, May 18-23, 1953.

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# RECOMMENDED GOOD PRACTICE RULES FOR LIQUEFIED PETROLEUM GAS PIPING AND APPLIANCE INSTALLATIONS IN BUILDINGS

## CONTENTS

## DEFINITIONS

The official NFPA definitions of shall, should and approved are:

SHALL is intended to indicate requirements.

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

APPROVED refers to approval by the authority having jurisdiction.

Units of measurements used here are U. S. standard. 1 U. S. gallon = 0.83 Imperial gallons = 3.785 liters.

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## APPROVED EQUIPMENT

The National Fire Protection Association does not "approve" individual items of fire protection equipment. The standards are prepared, as far as practicable, in terms of required performance, avoiding specifications of materials, devices or methods so phrased as to preclude obtaining the desired results by other means. The suitability of devices and materials for installation under these standards is indicated by the listings of nationally recognized testing laboratories, whose findings are customarily used as a guide to approval by agencies applying these standards. Underwriters' Laboratories, Inc., Underwriters' Laboratories of Canada and the Factory Mutual Laboratories test devices and materials for use in accordance with the appropriate standards, and publish lists which are available on request.

## Scope

This text provides standards governing the installation of LP-Gas piping and LP-Gas appliances in buildings. These standards are intended to cover the design, fabrication, installation, tests and operation of such equipments for undiluted liquefied petroleum gases. These standards do not cover:

1. Industrial installations, including piping in storage and filling plants, which are covered by NFPA Standards for the Storage and Handling of Liquefied Petroleum Gases (NFPA No. 58).*

2. Piping in utility plants nor in mains of distribution systems utilizing the gases which are covered by NFPA Standards for the Design, Installation and Construction of Containers and Pertinent Equipment for the Storage and Handling of Liquefied Petroleum Gases at Utility Gas Plants (NFPA No. 59).*

3. Utilities distribution piping of natural, manufactured or LP-Gas-Air, or mixtures thereof which are covered by NFPA Standards for the Installation of Gas Piping and Gas Appliances in Buildings (NFPA No. 54).*

## 1. General

(a) No person, unless in the employ of the gas distributing company or having permission from such company, shall repair, alter, open or make connection to the building piping system.

(b) Installation of all gas piping or gas appliances shall be performed with gas turned off to eliminate hazards from escape of gas.

## 2. Piping, Tubing and Fittings

(a) Piping shall be wrought iron or steel (black or galvanized), brass or copper pipe, or seamless copper, brass, steel or aluminum tubing. All piping or tubing shall be suitable for a working pressure of not less than 125 pounds per square inch. Copper tubing may be of the standard grade K or L, or equivalent having a minimum wall thickness of 0.032 inches. Aluminum tubing shall not be used in exterior locations or where it is in contact with masonry or plaster walls or insulation.

(b) Pipe joints may be screwed, flanged, welded, soldered or brazed with a material having a melting point exceeding 1000° F. For operating pressures of 125 pounds per square inch gauge or less, fittings shall be designed for a pressure of at least 125 pounds per square inch gauge. For operating pressures above this, fittings shall be designed for a minimum of 250 pounds per square inch gauge. Cast iron fittings shall be prohibited. Joints on seamless copper, brass, steel or non-ferrous gas tubing shall be made by means of approved gas tubing fittings, or soldered or brazed with a material having a melting point exceeding 1000° F.

(c) Gas appliances may be connected with seamless metal tubing connectors meeting the following requirements, except that these requirements shall in no way restrict or otherwise affect the use of copper tubing

*Published in National Fire Codes, Volume I, available from the National Fire Protection Association, 60 Batterymarch Street, Boston 10, Mass. ($4.00). These same standards are also published in separate pamphlet form and are available from either the NFPA or the National Board of Fire Underwriters, 85 John Street, New York 38, N. Y.

or any other piping when material, fittings, and installation comply with all other requirements of these rules:

1. End fittings shall be screw type or union type permanently attached.

2. The method of attaching tubing connectors to the house piping and the gas appliance shall conform with paragraph 2 (b).

(**d**) After installation, the piping and tubing of all domestic and commercial systems shall be tested, at not less than normal operating pressure, and proved free of leaks, using a manometer or other equivalent device that will indicate a drop in pressure. Test shall not be made with a flame.

### 3. Installation of Piping and Tubing

(**a**) Provision shall be made for expansion, contraction, jarring and vibration, and for settling. This may be accomplished by flexible connections.

(**b**) Piping or tubing shall be well supported and protected against physical injury.

(**c**) Where condensation may occur, the piping shall be pitched back to the container, or suitable means shall be provided for vaporization of the condensate.

(**d**) Compounds used in making up joints shall be resistant to the action of LP-Gases.

(**e**) Tubing shall not be run inside walls or partitions, unless protected against mechanical injury. This rule does not apply to tubing which is run through walls or partitions.

(**f**) Gas piping shall not be used as a ground for any electrical system, nor shall piping be located in the same conduit with electrical wiring.

(**g**) 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 source and the appliance or appliances. The size of gas pipe depends upon the following factors:

1. Allowable loss in pressure from source to appliance.
2. Maximum gas consumption to be provided for.
3. Length of pipe and number of fittings.
4. Specific gravity of the gas.

(**h**) Piping or tubing should be free of loose scale, dirt, dust, or other foreign material at the time of appliance installation.

(**i**) Defective pipe or tubing or fittings shall not be repaired but such section or fittings shall be replaced.

(**j**) Pipe, fittings, valves, etc., removed from any existing installation shall not be again used until they have been thoroughly cleaned, inspected, and ascertained to be suitable for the service.

(**k**) Pipe with threads which are stripped, chipped, corroded, or otherwise damaged shall not be used. If a weld opens during the operation of cutting or threading, that portion of the pipe shall not be used.

(**l**) Gas pipe or tubing inside any building shall not be run in or through an air duct, clothes chute, chimney or flue, ventilating duct, dumb waiter or elevator shaft, except proper ducts for the purpose.

(**m**) Each outlet, including a valve or cock outlet, shall be securely

closed gas-tight with a positive plug or cap if appliance is not to be connected at that time. When an appliance is removed from an outlet and the outlet is not to be reconnected at that time, it shall be securely closed gas-tight. In no case shall the outlet be closed with tin caps, wooden plugs, corks, etc.

(**n**) No device shall be placed inside the gas pipe or fittings that will reduce the cross sectional area or otherwise obstruct the free flow of gas.

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

### 4. Use of Approved Appliances

(**a**) New domestic and commercial gas-consuming appliances shall not be installed unless their correctness as to design, construction and performance is certified by one of the following:

1. Determined by a nationally recognized testing agency, adequately equipped and competent to perform such services, and shall be evidenced by the attachment of its seal or label to such gas appliances. This agency shall be one which maintains a program of national inspection of production models of gas appliances at least once each year on the manufacturer's premises. Approval by the American Gas Association Laboratories, as evidenced by the attachment of its listing symbol or Approval Seal to gas appliances and a certificate or letter certifying approval under the above-mentioned requirements, or listing by Underwriters' Laboratories, Inc., shall be considered as constituting compliance with the provisions of this section.

2. Approval by the authority having jurisdiction.

(**b**) Any appliance that was originally manufactured for operation with a gaseous fuel other than LP-Gas and is in good condition may be used with LP-Gas only after it is properly converted, adapted and tested for performance with LP-Gas before the appliance is placed in use.

(**c**) Any automatically controlled domestic appliances, except ranges, shall be equipped with an automatic pilot, complete shut-off type. See Appendix A definition. Manually controlled water heaters shall also be so equipped.

### 5. Appliance Installation Requirements

(**a**) *Air for Combustion.*

1. Appliances shall be installed in a location in which the facilities for ventilation permit satisfactory combustion of gas and proper venting, under normal conditions of use. While all forms of building construction cannot be covered in detail, this requirement may usually be met by application of one of the following methods in ordinary building construction:

(a) In buildings of conventional frame, brick, or stone construction without enclosed appliance rooms, basement storm windows, or tight stair doors, infiltration is normally adequate to provide air for combustion and draft hood dilution.

(b) Where appliances are installed in a confined space within a building having inadequate air infiltration, provisions shall be made for supplying this space with air for combustion

and ventilation. This may be accomplished through use of two permanent openings freely communicating with interior areas of adequate infiltration in accordance with Figure 1 (see Appendix "A") or by compliance with provisions of paragraph 5 (a) 1 (c). If necessary, continuous ducts having cross-sectional areas equal to the openings shall be utilized to communicate with the source of air supply. The minimum dimension of rectangular air ducts shall be not less than 3 inches.

(c) Where appliances are installed in a confined space within a building of unusually tight construction, air for combustion and ventilation must be obtained from outdoors or from spaces freely communicating with the outdoors, ventilated crawl space or attic. Under these conditions, the openings called for in Figure 1 (see Appendix "A") shall be replaced by two openings having a combined area of not less than one square inch per 1000 BTU per hour of input rating. One opening shall be near the top of the enclosure and one near the bottom. These openings shall be of approximately equal area and shall communicate with the selected source or sources of adequate air supply, by ducts. Where ducts are required, they shall be continuous and of the same cross-sectional area as the openings to which they connect. The minimum dimension of rectangular air ducts shall be not less than 3 inches. Any duct from the top opening must be horizontal or pitched upward.

(d) Where appliances are installed in unconfined spaces, such as a full basement, within a building of unusually tight construction, air for combustion and ventilation must be obtained from outdoors or from spaces freely communicating with the outdoors. Under these conditions a permanent opening or openings having a total free area of not less than one square inch per 1000 BTU per hour of input rating shall be provided. Where ducts are required, they shall be of the same cross-sectional area as the openings to which they connect. The minimum dimension of rectangular air ducts shall be not less than 3 inches.

(e) Operation of exhaust fans, kitchen ventilation systems or fireplaces may create conditions requiring special attention to avoid unsatisfactory appliance operation.

**(b)** 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.

**(c)** Every appliance shall be located so that it will be readily accessible for operation and servicing.

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

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

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

(g) Where air or oxygen under pressure is used in connection with the gas supply, effective means shall be provided to prevent air or oxygen from passing back into the gas piping. Where oxygen is used, see NFPA Standards for the Installation and Operation of Gas Systems for Welding and Cutting (NFPA No. 51).*

(h) Non-portable appliances shall be connected with gas piping or tubing or combinations thereof as set out in Section 2, paragraph (a).

(i) Only appliances which are fully portable in nature shall be connected with gas hose. Appliances equipped with a control valve or valves which permit complete shut-off of the gas supply shall not be connected with gas hose. This requirement does not apply to hand torches, gas irons and other equipment which require both the mobility possible only with flexible connections and frequent and accurate burner control at the point of use. Gas hose should not be confused with tubing or appliance connectors of flexible metal tubing and fittings.

(j) Only listed gas hose shall be used. Listed gas hose shall be used only in accordance with the terms of its listing. Gas hose shall not be used where it is likely to be subject to excessive temperatures (above 125° F.).

(k) Where gas hose connection is made, a gas shut-off valve shall always be provided on the supply piping where the hose is attached. When gas hose is used with an appliance having a valve on the inlet of the appliance, the valve shall be removed so that the user is compelled to use the valve at the pipe end except as provided by paragraph 5 (i). A gas shut-off valve which constitutes the only means of gas control shall be easily accessible and within convenient reaching distance when operating the burner of the appliance.

(l) Gas hose shall be of adequate capacity, gas tight, and so designed as to permit the secure attachment to the nozzles of fully portable appliances which do not require mobility during operation and to hose end valves connected to the house piping. Where the gas hose is equipped with rubber slip end connections, the gas shut-off valve at the house piping shall be a hose end gas valve or shall have a standard hose end nozzle attached to it. Where an appliance requires mobility during operation, such as a gas iron or hand torch, and is always used in the same location, the gas hose shall be permanently attached at the supply end by a threaded or other secure metal connection, and the appliance end shall be provided with a secure metal joint, which can be conveniently made and separated.

(m) Where gas hose is used, it shall be of the minimum practical length and shall not extend from one room to another nor pass through any walls, partitions, ceilings or floors. Under no circumstances shall gas hose be concealed from view or used in a concealed location.

(n) 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.

* Published in National Fire Codes, Volume I, available from the National Fire Protection Association and in separate pamphlet form from either the NFPA or the National Board of Fire Underwriters.

(o) The gas piping shall not be used for an electrical ground nor shall electric circuits utilize gas piping, casing of controls, panels or other metal parts in lieu of wiring. This provision shall not apply to low voltage control and ignition circuits, and to electronic flame detection device circuits incorporated as part of the appliance.

(p) 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.

(q) 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. It is recommended that central heating gas appliances for domestic use be provided with a separate electrical circuit.

(r) 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 be installed in the hot wire side of the transformer primary.

(s) It is recommended that multiple conductor cable, not lighter than No. 18 American Wire Gauge, 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.

(t) To assure good response by the room temperature thermostat, it should be located where it will be in the natural circulating path of room air. Avoid locations which would expose the device to cold air infiltration or drafts from windows, doors, or other openings leading to the outside, or to air currents from warm or cold air registers, or where the natural circulation of the air is cut off, such as behind doors, above or below mantels, shelves, or in corners. Placing a thermostat which controls a central heating appliance in a bedroom, bathroom, or kitchen is not recommended.

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

(v) 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.

## 6. Domestic Ranges

(a) The location of a domestic gas range shall be such as not to constitute a hazard to persons or property. In the application of this requirement, appropriate consideration shall be given to the design and construction of the range and the combustibility of the floor, wall or partition. Listed domestic gas ranges (except bungalow and dual oven type combination gas ranges, for which see paragraph 6 (e) ) when installed on combustible floors shall be set on their own bases or legs and shall be installed with clearances not less than shown in Table 1. In no case shall the clearance be such as to interfere with the requirements for combustion air and ac-

cessibility. See paragraphs 5 (a) and 5 (c). Unlisted domestic gas ranges shall be installed with at least a 6-inch clearance from back and sides. Combustible floors under unlisted ranges shall be protected in an approved manner.*

## Table 1

MINIMUM CLEARANCE FOR LISTED DOMESTIC GAS RANGES

| Type of Range | Spacing of Top Burner Opening From Side of Range | Distance from Combustible Construction — Inches | | | |
|---|---|---|---|---|---|
| | | Sides | | Rear | |
| | | Wall Not Extending Above Cooking Top | Wall Extending Above Cooking Top | Body of Range | Projecting Flue Box |
| A Uninsulated | ..... | 6 | 6 | 6 | 1 |
| B (Insulated** | Less than 5 in. | 1/2 | 3 | 1 | 1 |
| (Insulated | 5 in. or more | 1/2 | 1/2 | 1 | 1 |
| C (Flush to Wall | Less than 5 in. | Flush | 3 | Flush | ... |
| (Flush to Wall | 5 in. or more | Flush | Flush | Flush | ... |

**Approved as insulated models in accordance with American Standard Approval Requirements for Domestic Gas Ranges Z21.1

(b) Where a flue or vent connector is attached to a domestic gas range, suitable provisions shall be made for the protection of adjacent combustible construction from excessive temperatures. (See paragraph 26 (g) .) By combustible construction is meant a combustible surface constructed of wood, composition, or of wooden studding and wood lath and plaster.

(c) Domestic gas ranges shall have a vertical clearance above the cooking top of not less than 36 inches to combustible construction. When the underside of such combustible construction is protected with asbestos mill board at least 1/4-inch thick, covered with sheet metal of not less than No. 28 U. S. Gauge, the distance shall be not less than 24 inches. The protection shall extend 9 inches beyond the sides of the range.

(d) All gas ranges shall be installed so that the cooking top and oven racks are level.

(e) Bungalow type domestic gas ranges** or dual oven type combination gas ranges** shall be spaced from combustible construction and otherwise installed in accordance with the standards applying to the supplementary fuel section of the range.

* For details of protection see Building Code Standards of the National Board of Fire Underwriters for the Installation of Heat Producing Appliances, obtainable from the National Board of Fire Underwriters, 85 John Street, New York, New York.

** See Appendix "A" for definition.

## 7. Water Heaters

(a) Water heaters shall not be installed in bathrooms or bedrooms, unless vented in compliance with Section 27.

(b) Water heaters shall be located as close as practicable to the flue or vent. They should be so located as to provide short runs of piping to fixtures.

(c) Listed gas-fired water heaters shall be positioned in relation to combustible construction with a minimum clearance in accordance with Table 2. In no case shall the clearances be such as to interfere with the requirements for combustion air and accessibility. See paragraphs 5 (a) and 5 (c). 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.*

### Table 2

MINIMUM CLEARANCES FOR LISTED GAS-FIRED WATER HEATERS

| Type of Heater** | Distance from Combustible Construction — Inches | |
|---|---|---|
| | Nearest Part of Jacket | Flat Side |
| Type A | 6 | ... |
| Type B | 2 | ... |
| Type C | ... | Flush |

**Type A — Miscellaneous (including circulating tank, instantaneous uninsulated underfired).
Type B — Underfired, insulated automatic storage heaters.
Type C — Type B units with one or more flat sides and tested for installation flush to wall.

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

(e) No water heater shall be installed in a closed system of water piping unless an approved water pressure relief valve is provided.

(f) The installation and adjustment of temperature, pressure, and vacuum relief valves or combinations thereof, and automatic gas shut-off valves shall be in accordance with the requirements of the proper administrative authority, or, with the manufacturer's instructions accompanying such devices.

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

* For details of protection see Building Code Standards of the National Board of Fire Underwriters' for the Installation of Heat Producing Appliances, obtainable from the National Board of Fire Underwriters', 85 John Street, New York, New York.

(**h**) The method of connecting the circulating water heater to the tank shall assure proper circulation of water through the heater, and permit a safe and useful temperature of water to be drawn from the tank. (See Figure 2 in Appendix "A".)

(**i**) The size of the water circulating piping, in general, shall conform with the size of the water connections of the heater.

(**j**) 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.

(**k**) Means acceptable to the proper administrative authority shall be provided to prevent syphoning 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 2 in Appendix "A.")

## 8. Room or Space Heaters

(**a**) A room or space 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 incombustible fire-resistive fireplace only," shall not be installed elsewhere. Listed room or space heaters shall be installed with clearances not less than specified in Table 3, 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 paragraphs 5 (a) and 5 (c).)

(**b**) Unlisted room or space heaters shall be installed with clearances from combustible construction not less than the following:

1. 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 clearances at sides and rear of not less than 12 inches.

2. RADIATING TYPE. Room heaters other than those described above as of circulating type shall have clearances at sides and rear of not less than 18 inches; except that heaters which make use of metal,

### Table 3

MINIMUM CLEARANCES FOR LISTED GAS-FIRED ROOM HEATERS

| Type | Distance from Combustible Construction — Inches | |
|---|---|---|
| | Jacket, Sides and Rear | Projecting Flue Box or Draft Hood |
| Warm Air Circulators | 6 | 2 |
| Radiant Heaters | 6 | 2 |
| Wall Heaters | Flush | ... |
| Gas, Steam and Hot Water Radiators | 6 | 2 |

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.

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

## 9. Wall Type Room Heaters

(a) Wall type room or space heaters shall not be installed in walls of combustible construction unless approved for such installations.

(b) Room or space heaters shall be vented as specified by Section 23. It is recommended that room or space heaters installed in all sleeping quarters or rooms generally kept closed be vented to an effective flue or vent and equipped with an automatic pilot.

## 10. Central Heating Boilers and Furnaces

(a) Where a complete shut-off type automatic pilot system is not utilized a manual main shut-off valve shall be provided ahead of all controls except the manual pilot gas valve.

(b) Where a complete shut-off type automatic pilot system is utilized, a manual main shut-off valve shall be provided ahead of all controls. A suitable manual valve shall be provided for shutting off the main burner gas independently of the pilot gas.

(c) A union connection shall be provided downstream from the main manual shut-off valve to permit removal of the controls.

(d) Listed central heating boilers and furnaces shall be installed with clearances not less than specified in Table 4, except that appliances 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 the requirements for combustion air and accessibility. See paragraph 5 (a) and Sec. 10 (f). Unlisted central heating boilers and furnaces shall be installed with clearances from combustible construction 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, except that the clearance above and at the sides and rear may be 6 inches for appliances of the following types:

1. Mechanical warm air furnaces which are automatically fired and equipped with a fan to circulate the air and with approved automatic temperature limit controls that cannot be set higher than 250° F.

2. Hot water and steam boilers operating at not over 15 lbs. gauge pressure, of water-wall type or having a jacket or lining of masonry or other satisfactory insulating material.

(e) A central heating boiler or furnace shall be erected in accordance with the manufacturer's instructions and shall be installed on a firm, level, fire resistive foundation unless listed for installation on a combustible floor,

* For details of protection see Building Code Standards of the National Board of Fire Underwriters for the Installation of Heat Producing Appliances, obtainable from the National Board of Fire Underwriters, 85 John Street, New York, New York.

or the floor is protected in an approved manner. (See footnote to paragraph 6 (a).)

(**f**) The installation of central heating boilers and furnaces shall be such as to make them accessible for cleaning of heating surfaces, removal of burners, replacement of sections, motors, controls, filters, draft hoods and other working parts, and for adjustment and lubrication of parts requiring such attention.

**Table 4**

MINIMUM CLEARANCES
FOR LISTED CENTRAL HEATING BOILERS AND FURNACES

| Type of Appliance | Distance from Combustible Construction — Inches | | | |
|---|---|---|---|---|
| | Above | Jacket Sides and Rear | Front | Projecting Box or Draft Hood |
| Boilers | 6 | 6 | 18 | 6 |
| Furnaces | 18* | 6 | 18 | 6 |

* A vertical clearance of 6 inches may be used with warm air furnaces equipped with mechanical means to circulate the air and with an approved temperature limit control that cannot be set higher than 250° F.

(**g**) The method of connecting the flow and return pipes on steam and hot water boilers shall facilitate a rapid circulation of steam or water. For common piping systems, reference may be made to the American Society of Heating and Ventilating Engineers' "Heating, Ventilating, Air Conditioning Guide,"* and to The Institute of Boiler and Radiator Manufacturers' (IBR) Guides.**

(**h**) A steam or hot water boiler shall be provided with a direct connection to a water supply through an individual control valve. A drain valve, by means of which the boiler may be flushed or drained, also shall be provided.

(**i**) Steam and hot water boilers shall be provided with approved automatic devices to shut down the burner in the event of undue pressure or low water in a steam boiler or overheating in a hot water boiler.

(**j**) A plenum chamber when not a part of a furnace shall be constructed in accordance with the manufacturer's instructions. The method of connecting supply and return ducts shall facilitate proper circulation of air. Reference may be made to the Standards of the National Fire Protection Association for the "Installation of Air Conditioning, Warm

*Copies may be obtained from the American Society of Heating and Ventilating Engineers, 51 Madison Avenue, New York 10, New York.

** Copies may be obtained from the Institute of Boiler and Radiator Manufacturers, 60 E. 42nd Street, New York 17, New York.

Air Heating, Air Cooling and Ventilating Systems" (NFPA No. 90),* and to the Design and Installation Manuals of the National Warm Air Heating and Air Conditioning Association.**

## 11. Recessed Heaters†

(a) Listed recessed heaters may be installed in combustible construction. Unlisted recessed heaters shall not be installed in combustible construction. Because of the necessity for closely correlating the installation of recessed heaters with the building construction, local administrative authorities shall be consulted for the proper installation methods to be followed. Recessed heaters should be installed in accordance with the manufacturer's instructions.

(b) Recessed heaters shall be located so as not to cause a hazard to walls, floors, curtains, furniture, doors, etc. Recessed heaters installed between bathrooms and adjoining rooms shall not circulate air from bathrooms to other parts of the building.

(c) A manual main shut-off valve shall be installed ahead of all controls including the pilot gas valve.

(d) The installation of recessed heaters shall be such as to make them accessible for cleaning of heating surfaces, removal of burners, replacement of sections, motors, controls, filters, and other working parts, and for adjustment and lubrication of parts requiring such attention. Panels, grilles and access doors which must be removed for normal servicing operations shall not be attached to the building construction.

(e) Adequate combustion and circulating air shall be provided. (See paragraph 5. (a).)

## 12. Floor Furnaces

(a) Listed floor furnaces may be installed in combustible floors. Unlisted floor furnaces shall not be installed in combustible floors.

(b) A separate manual main shut-off valve shall be provided ahead of all controls, and a union connection shall be provided downstream from this valve to permit removal of the controls or the floor furnace.

(c) Fixed ventilation by means of a duct or grille, arranged to supply air from a permanently ventilated attic or underfloor space, shall be provided to any confined space which encloses the floor furnace. The duct or grille shall be screened and have a free area at least twice the free area of the vent collar of the floor furnace or one square inch per 1000 BTU per hour of gas input, whichever is the greater, and shall be installed in such a manner as to insure proper combustion.

(d) The following are requirements that will serve in properly placing the furnace or furnaces to serve one story:

1. No floor furnace shall be installed in the floor of any aisle or

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* Published in National Fire Codes, Volume III, available from the National Fire Protection Association and in separate pamphlet form available from either the NFPA or the National Board of Fire Underwriters.

** National Warm Air Heating and Air Conditioning Association, 145 Public Square, Cleveland 14, Ohio.

† See Definition in Appendix A.

passageway of any auditorium, public hall or place of assembly, or in any exitway from any such room or space.

2. WALLS AND CORNERS: With the exception of wall-register models, a floor furnace shall not be placed closer than 6 inches to the nearest wall, and wall-register models shall not be placed closer than 6 inches to a corner.

3. DRAPERIES: The furnace shall be so placed that a door, drapery, or similar object cannot be nearer than 12 inches to any portion of the register of the furnace.

4. CENTRAL LOCATION: Generally speaking, the more central the location, the better, favoring slightly the sides exposed to the prevailing winter winds.

(e) The floor around the furnace shall be braced and headed with a framework of material not lighter than the joists.

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

(g) The lowest portion of the floor furnace shall have at least a 6-inch clearance from the general ground level, except that where 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.

(h) Provision shall be made for access to the furnace by means of an opening in the foundation wall of at least 18 by 24 inches or through a trap door of at least 24 by 24 inches, located at some convenient point, and a clear and unobstructed passageway to the furnace at least 18 inches high by 24 inches wide.

(i) Whenever the excavation exceeds 12 inches or water seepage is likely, a water-tight copper pan, concrete pit, or other suitable material shall be used. 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 12-inch clearances on all sides except the control side, which shall have 18-inch clearance. When the equipment is sealed by the manufacturer to meet this condition, the pan or pit may be omitted if not required for maintaining a dry condition for service access.

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

(k) Listed gas 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 paragraph 12 (c) with access facilities for servicing on the control side 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.

### 13. Duct Furnaces

(a) Listed gas-fired duct furnaces shall be installed with clearances of at least six inches between adjacent walls, ceilings and floors of combustible construction and the appliance, projecting flue box or draft hood, except that duct furnaces listed for installation at lesser clearance may be installed in accordance with their listings. In no case shall the clearance be such as to interfere with the requirements for combustion air and accessibility. (See paragraphs 5 (a) and 13 (d).) Unlisted duct furnaces shall be installed with clearances to combustible construction in accordance with the requirements for central heating furnaces and boilers, paragraph 10 (b). Combustible floors under unlisted duct furnaces shall be protected in an approved manner. (See footnote to paragraph 6 (a).)

(b) A duct furnace shall be erected and firmly supported in accordance with the manufacturer's instructions.

(c) The installation of duct furnaces shall be such as to make them accessible for cleaning the heating surfaces, removal of burners, replacement of sections, controls, draft hoods and other working parts, and for adjustment of parts requiring such attention.

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

(e) The controls 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.

(f) Circulating air shall not be taken from the same enclosure in which the furnace is located.

(g) Duct furnaces when used in conjunction with a refrigeration system shall not be located downstream from the evaporator coil.

### 14. Conversion Burners

(a) Installation of conversion burners shall conform to American Standard Requirements for Installation of Domestic Gas Conversion Burners, Z21.8–1948.

### 15. Gas-Fired Unit Heaters

(a) Suspended type gas-fired unit heaters shall be safely and adequately supported with due consideration given to their weight and vibration characteristics.

(b) Listed gas-fired unit heaters shall be installed with minimum clearances of six inches between the appliance, projecting flue box or draft hood and combustible construction. The control side of a unit heater shall be spaced not less than 18 inches from any wall or partition. Unlisted unit heaters shall be installed with clearances to combustible construction of not less than 18 inches. Combustible floors under unlisted floor mounted unit heaters shall be protected in an approved manner. (See footnote to paragraph 6 (a).)

(c) The location of any unit heater or the duct work attached thereto shall be such that a negative pressure will not be created in the room in which the unit heater is located.

(d) A unit heater shall not be attached to a warm air duct system unless listed for such installation.

(e) Unit heaters installed in garages for more than 3 motor vehicles or in aircraft hangars shall be of a type listed for such use and be installed at least 8 feet above the floor.

### 16. Clothes Dryers

(a) Listed clothes dryers shall be installed with minimum clearances of 6 inches from adjacent combustible construction, except that clothes dryers listed for installation at lesser clearances may be installed in accordance with their listings. A minimum clearance of 16 inches shall be provided between the top of the flue and the lower surface of any combustible material located above the dryer. Unlisted clothes dryers shall be installed with clearances to combustible construction of not less than 18 inches. Combustible floors under unlisted clothes dryers shall be protected in an approved manner. (See footnote to paragraph 6 (a).)

(b) Gas-fired clothes dryers installed for multiple family use shall be equipped with approved automatic pilots.

### 17. Gas-Fired Incinerators

(a) Listed gas-fired incinerators shall be installed as close as practicable to a chimney and with at least 12 inches clearance between sides and combustible construction, except that appliances listed for installation at lesser clearances may be installed in accordance with their listing. In no case shall the clearance be such as to interfere with the requirements for combustion air and accessibility. (See paragraphs 5 (a) and 5 (c).) Incinerators of the wall type shall be installed in a noncombustible wall communicating directly with a chimney flue. Unlisted incinerators shall be installed with clearances to combustible construction of not less than 18 inches and shall not be installed on combustible floors unless the floor under the appliance is protected in an approved manner. (See footnote to paragraph 6 (a).)

(b) No draft hood shall be connected into the smoke pipe of an incinerator. Where conditions permit, it is preferable to have the smoke pipe connected to a separate chimney flue. (See paragraph 27 (g).)

(c) Smoke pipes shall have at least 18 inches clearance from combustible construction and shall not pass through combustible construction unless guarded at the point of passage, as specified in paragraph 26 (h)1.

(d) The smoke pipe from an incinerator to a Type A flue or vent shall be galvanized steel of a thickness at least No. 24 U. S. Standard Gauge, or of material having equivalent or superior heat and corrosion resistant properties, and the joints shall be secured by sheet metal screws.

### 18. Gas Refrigerators

(a) Gas 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 two inches shall be provided between the back of the refrigerator and the wall and at least a 12-inch clearance above the top.

### 19. Hot Plates and Laundry Stoves

(a) Listed domestic hot plates and laundry stoves when 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 construction. Unlisted domestic hot plates and laundry stoves shall be installed with horizontal clearances to combustible construction of not less than 12 inches. Combustible surfaces under unlisted domestic hot plates and laundry stoves shall be protected in an approved manner. (See footnote to paragraph 6 (a).)

(b) The vertical distance between tops of all domestic hot plates and laundry stoves and combustible construction shall be at least 36 inches.

### 20. Hotel and Restaurant Ranges, Deep Fat Fryers and Unit Broilers

(a) Listed hotel and restaurant ranges, deep fat fryers and unit broilers, when set on their own bases or legs, may be installed on unprotected combustible floors unless marked "For use only in fire-proof locations."

(b) Hotel and restaurant ranges, deep fat fryers, and unit broilers, which are not listed for mounting on a combustible floor shall be mounted on fire resistive floors or be mounted in accordance with one of the following paragraphs, or in some manner substantially equivalent thereto that is acceptable to the administrative authority.

1. Where 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. Where 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 $\frac{3}{8}$ inch asbestos mill board covered with sheet metal of not less than 24 U. S. Standard Gauge. The above specified floor protection shall extend not less than 6 inches beyond the appliance on all sides.

3. Where 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 24 U. S. Standard Gauge. 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. The hollow masonry shall be kept in place by a holding strip fastened to the floor on all four sides. The ends of hollow masonry shall be not less than 3 inches from any wall or obstruction.

4. Where 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. The tile shall be kept in place by a holding strip fastened to the floor on all four sides. The ends of the tile shall be not less than 3 inches from any wall or obstruction.

(c) Listed hotel and restaurant ranges, deep fat fryers and unit broilers shall be installed at least 6 inches from combustible construction except that at least a 2-inch clearance shall be maintained between the flue box or draft hood and combustible construction. Appliances designed and marked "For use only in fireproof locations" shall not be installed elsewhere.

(d) Unlisted hotel and restaurant ranges, deep fat fryers and unit broilers shall be placed not closer than 18 inches to any combustible construction, unless such combustible construction is protected by sheet metal of not less than 26 U. S. Standard Gauge. This sheet metal shall be fastened to the combustible construction by thimbles, spaced at not less than 2-foot vertical and horizontal intervals, and provide 1.5 inch clearance between the sheet and combustible construction. In such cases, the clearance between the sheet and the appliance shall be not less than 4½ inches. Where sheet metal protection is used, the 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 combustible construction shall be open on both sides or top and bottom to permit circulation of air.

(e) Any portion of combustible construction adjacent to a cooking top section of a hotel or restaurant range, even though certified 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 paragraph 20 (d) for a distance of at least 2 feet above the surface of the cooking top.

(f) All hotel and restaurant ranges, deep fat fryers and unit broilers shall be installed level on a firm foundation.

(g) Adequate means shall be provided to properly ventilate the space in which hotel and restaurant equipment is installed to permit proper combustion of the gas. When exhaust fans are used for ventilation, special precautions may be required to avoid interference with the operation of the equipment.

## 21. Gas Counter Appliances

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

(b) Listed gas counter appliances, such as commercial hot plates and griddles, food and dish warmers, coffee brewers and urns, waffle bakers and hot water immersion sterilizers, when installed on combustible surfaces shall be set on their own base or legs, and shall be installed with a minimum horizontal clearance of 6 inches from combustible construction.

(c) Unlisted commercial hot plates and griddles shall be installed with a horizontal clearance from combustible construction of not less than 18 inches. Unlisted gas counter appliances, such as coffee brewers and urns, waffle bakers and hot water immersion sterilizers, shall be installed with a horizontal clearance from combustible construction of not less than 12 inches. Gas counter appliances may be installed with lesser clearances than specified above where the combustible construction is protected in an approved manner. (See footnote to paragraph 6 (a).) Unlisted food and dish warmers shall be installed with a horizontal clearance from combustible construction of not less than 6 inches. Combustible surfaces under unlisted gas counter appliances shall be protected in an approved manner.

### 22. Portable Gas Baking and Roasting Ovens

(a) Listed portable gas baking and roasting ovens shall be installed at least 6 inches from combustible construction, except that at least a 2-inch clearance shall be maintained between the flue box or draft hood and combustible construction. Appliances designed and marked "For use only in fireproof locations" shall not be installed elsewhere. Unlisted portable baking and roasting ovens shall be installed with clearances to combustible construction of not less than 18 inches. Combustible floors under unlisted portable gas baking and roasting ovens shall be protected in an approved manner. (See footnote to paragraph 6 (a).)

### 23. Venting of Appliances

(a) Room heaters in sleeping quarters for use of transients, or in institutions, such as homes for the aged, sanatoriums, convalescent homes, orphanages, etc., shall be flue connected or otherwise vented to carry off the products of combustion.

(b) Other appliances shall be vented in accordance with modern requirements for safe practice.

NOTE: Detailed requirements for the venting of appliances are under consideration by the NFPA Committee on Gases; these will be submitted for adoption just as soon as agreement is reached.

### 24. Draft Hoods

(a) Every vented appliance, except incinerators, dual oven type combination ranges, and units designed for power burners or for forced venting, shall have a draft hood. If the draft hood is not a part of the appliance or supplied by the appliance manufacturer, it shall be supplied by the installer and in the absence of other instructions shall be the same size as the appliance flue collar. (For suggested general dimensions for such draft hoods, see Figures 3, 4, and 5 in Appendix "A.")

(b) Where the draft hood is a part of the appliance or is supplied by the appliance manufacturer it shall be installed without alteration in accordance with the manufacturer's instructions. In the absence of manufacturer's instructions the draft hood shall be attached to the flue collar of the appliance or as near to the appliance as conditions permit. 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.

(c) 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 so located that the relief opening is not obstructed by any part of the appliance or adjacent construction.

(d) Where the installer must supply a draft hood of special design, advice of the local gas company or the proper administrative authority as to its use should be secured.

### 25. Types of Flues or Vents

(a) Type A flues* or vents* shall be employed for venting:

1. All incinerators.

2. All appliances which may be converted readily to the use of solid or liquid fuels.

3. All boilers and warm-air furnaces except where the proper administrative authorities approve the use of Type B gas flues or vents.

(b) Type B gas flues* or vents* shall be used only with approved gas appliances which produce flue gas temperatures not in excess of 550° F. at the outlet of the draft hood when burning gas at the manufacturer's normal input rating and not specified by paragraph 25 (a) to be vented to Type A flues* or vents.*

(c) For the purpose of this provision listed appliances, with the exception of incinerators and conversion burners, may be accepted as producing flue gas temperatures not in excess of 550° F. at the outlet of the draft hood.

(d) Chimneys, flues or vents installed for use with gas appliances, but which are not suitable for solid or liquid fuels, shall be plainly and permanently labeled:

"This flue is for use of gas-burning appliances only."

The label shall be attached to the wall or ceiling at a point near where the flue or vent connector enters the chimney, or, where a Type B gas flue or vent is used in place of a chimney, at a point near where the Type B gas flue or vent or the flue or vent connector enters the wall or ceiling.

(e) Type C gas flues or vents 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. Such flues or vents shall not pass through any attic or concealed space nor through any floor. Installation with reference to clearance to combustible construction and passage through wall or roof shall comply with provisions of paragraphs 26(g) and 26(h)1.

### 26. Flue or Vent Connectors

(a) The material used for the flue or vent connector shall be resistant to corrosion and be of sufficient thickness to withstand damage. Where a question arises as to the suitability of a particular material, the proper administrative authority should be consulted.

* See Appendix A for definitions.

(b) The flue or vent connector shall be installed so as to avoid short turns or other constructional features which would create excessive resistance to the flow of flue gases.

(c) The flue or vent connector shall maintain a pitch or rise from the appliance to the flue or vent. A rise as great as possible, at least ¼ inch to the foot (horizontal length), shall be maintained. The horizontal run shall be free from any dips or sags.

(d) Wherever sufficient headroom is available, appliances having a horizontal flue outlet shall be provided with a vertical run of flue or vent connector before the horizontal run. To minimize frictional resistance in the connector, it is recommended that 45° elbows be used.

(e) The horizontal run of the connector shall be as short as possible and the appliance shall be located as near the flue or vent as practicable. The maximum length of horizontal run shall not exceed 75% of the height of the flue or vent.

(f) Flue or vent connectors shall be securely supported.

(g) Where flue or vent connectors pass through partitions of combustible construction, ventilated thimbles shall be used. Minimum clearances from combustible construction to flue or vent connectors for listed appliances are shown in Table 5. For unlisted appliances the minimum clearance shall be 9 inches from metal flue or vent connectors except for incinerators where the minimum clearance shall be 18 inches.

## Table 5

FLUE OR VENT CONNECTOR CLEARANCES FOR LISTED APPLIANCES

| Appliance | Minimum Distance from Combustible Construction | |
|---|---|---|
| | Metal Flue or Vent Connectors | Type B Flue or Vent Connectors |
| Boiler | 6 inches | 1 inch[1] |
| Warm Air Furnace | 6 inches | 1 inch[1] |
| Water Heater | 6 inches | 1 inch[1] |
| Space Heater | 6 inches | 1 inch[1] |
| Floor Furnace | 9 inches | 3 inches* |
| Incinerator | 18 inches | Not Permitted |

[1] Except as otherwise specified in the listing by a nationally recognized testing agency.

* 3 inches for a distance of not less than three feet from outlet of the draft hood. Beyond three feet the minimum clearance is one inch.

The clearance from metal flue or vent connectors to combustible construction may be reduced as specified in Table 6 where the combustible construction is protected in accordance with this Table.

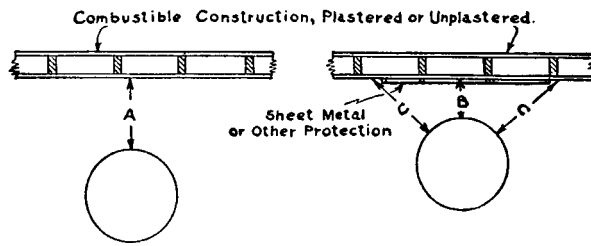
(h) Flue or vent connectors, other than Type B, shall not pass through any combustible walls or partitions unless they are guarded at the point of passage by ventilated metal thimbles not smaller than the following:

1. For listed appliances, except floor furnaces and incinerators — 4 inches larger in diameter than the flue or vent connector, unless there is a run of not less than 6 feet of flue or 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 flue or vent connector.

2. For listed floor furnaces and all unlisted appliances, except incinerators — 6 inches larger in diameter than the flue or vent connector.

3. For incinerators — 12 inches larger in diameter than the flue or vent connector.

(i) The flue or vent connector shall not be smaller than the size of the flue collar or the size of the outlet of the draft hood supplied by the manufacturer of a gas-designed appliance. Where the appliance has more than one flue outlet, and in the absence of the manufacturer's specific instructions, the flue or vent connector shall equal the combined area of the flue outlets for which it acts as a common connector to the flue or vent.




A equals the required clearance with no protection as specified in Table 5.
B equals the reduced clearance permitted in accordance with Table 6.
The protection applied to combustible construction is required to extend far enough in each direction to make C equal to A.

(j) No manually operated damper shall be placed in any flue or vent connector. Fixed baffles ahead of draft hoods are not classified as dampers.

(k) A flue or vent connector shall not be connected to a chimney flue having a fireplace opening unless the opening is permanently sealed.

## 27. Flues or Vents

(THIS SECTION APPLIES ONLY TO NATURAL DRAFT VENTING. FORCED DRAFT OR EXHAUST SYSTEMS AND POWER BURNERS USUALLY REQUIRE SPECIAL ENGINEERING AND INSTALLATION AND SHOULD BE APPROVED BY THE PROPER ADMINISTRATIVE AUTHORITY.)

(a) Before connecting a flue or vent connector, the flue or vent shall be examined to ascertain that it is properly constructed, clear, and will freely conduct the products of combustion to the outer air.

## Table 6

CLEARANCES WITH SPECIFIED FORMS OF PROTECTION

| Type of Protection | Where the required clearance with no protection is: | | |
|---|---|---|---|
| | 6 Inches Clearance Reduced to | 9 Inches Clearance Reduced to | 18 Inches Clearance Reduced to |
| ¼ in. asbestos millboard spaced out 1 in. with noncombustible spacers | 3 inches | 6 inches | 12 inches |
| 28 gauge sheet metal on ¼ in. asbestos millboard | 2 inches | 4 inches | 12 inches |
| 28 gauge sheet metal spaced out 1 in. with noncombustible spacers | 2 inches | 4 inches | 9 inches |

(b) The flue or vent to which the flue or vent connector is connected shall be of a size not less than specified in Figure 6 (see Appendix "A"). In no case shall the area be less than the area of 3-inch diameter pipe. When more than one appliance vents into a flue or vent, the flue or vent areas shall be not less than the area of the largest flue or vent connector plus 50 percent of the areas of the additional flue or vent connectors. An elliptical flue or vent may be used, provided its flue gas venting capacity is equal to the capacity of round pipe for which it is substituted.

(c) The flue or vent should extend high enough above the building or other neighboring obstruction so that wind from any direction will not strike the flue or vent from an angle above horizontal. Unless the obstruction is of great magnitude, it is usual experience that flue or vent extended at least two feet above flat roofs or two feet above the highest part of wall parapets and peaked roofs within 30 feet will be reasonably free from down drafts. (See Figure 7, Appendix "A.")

(d) In entering a chimney flue, the connection shall be above the extreme bottom to avoid stoppage. Means shall be employed which will prevent the flue or vent connector from entering so far as to unduly 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 flue or vent connector for cleaning.

(e) Cleanouts shall be of such construction that they will remain tightly closed when not in use.

(f) An automatically controlled gas appliance connected to a flue which also serves equipment for the combustion of solid or liquid fuel shall be equipped with an automatic pilot. A gas appliance flue or vent connector and a smoke pipe from an appliance burning another fuel may be connected into the same flue through separate openings, or may be con-

nected through a single opening if joined by a Y fitting, located as close as practical to the flue. If two or more openings are provided into one flue they should be at different levels.

(**g**) In order to promote better draft where more than one gas appliance flue or vent connector is connected to a flue or vent, the connections should be made at different levels. Two or more gas appliances may be vented through a common flue or vent connector when necessary, if joined by Y fittings as close as practical to the flue or vent, and provided the size of the common flue or vent is sufficient to accommodate the total volume of flue gases. Y fittings shall be made so that the angle at which the flue or vent connectors intersect is as small as possible, and should not exceed 45°.

(**h**) Where an existing chimney is unlined or where local experience indicates that flue gas condensate might be a problem, consult the local gas distributor for information about liners that are suitable for the locality.

### 28. Outside Flues or Vents

(**a**) Outside flues or vents are not recommended and they are particularly unsuccessful in severe climates and in small sizes, but when they must be used the material shall be resistant to the action of combustion products and shall possess high insulation qualities or be adequately insulated to minimize condensation and aid draft.

(**b**) When a flue or vent must be installed on the outside of the building, it shall be securely supported. A capped "tee" shall be installed at base of the riser, with an opening to drain off condensate. A suitable vent cap which does not obstruct or reduce the effective cross-sectional area of the flue or vent outlet shall be placed on top of the riser.

## APPENDIX A

### Definitions

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 or inlets.

APPLIANCE — A gas appliance is any device which utilizes gas fuel to produce light, heat or power.

APPLIANCE AUTOMATICALLY CONTROLLED — Appliances equipped with automatic devices which:

a. Accomplish complete turn-on and shut-off of the gas to the main burner or burners.

b. Graduate the gas supply to the burner or burners, but do not effect complete shut-off of the gas.

APPLIANCE FLUE — The flue passages within the appliance.

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

AUTOMATIC GAS SHUT-OFF VALVE — A device so constructed that the attainment of a temperature in the medium being heated in excess of some predetermined limit acts upon a chemical or metallic element in such a way as to cause the gas to the appliance to be shut off and remain off.

AUTOMATIC IGNITION — Automatic ignition shall be interpreted as means which provide for ignition of the gas at a burner when the gas burner valve controlling the gas to that burner is turned on, and will effect reignition if the flames on the burner have been extinguished by means other than closing the gas burner valve.

AUTOMATIC PILOT — Consists of an automatic pilot device and pilot burner securely assembled in fixed relationship.

AUTOMATIC PILOT DEVICE — A device employed with gas burning equipment which will automatically shut off the gas supply to the burner being served by either direct or indirect means when the pilot flame is extinguished. The pilot burner may or may not be constructed integrally with the device.

AUTOMATIC PILOT, COMPLETE SHUT-OFF TYPE — An automatic pilot for shutting off, automatically, the gas supply to the main burner and pilot in event of pilot or gas failure, and also for preventing the gas from being turned into the main burner unless the pilot is lighted.

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

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

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.

BUNGALOW RANGE — (See Combination Range). A range similar to a combination range supplied with gas oven and top burner sections and a supplementary fuel section used primarily for space heating or for heating a solid top section and not for oven heating.

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. PRE-MIXING 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 in. of water and occasionally higher).

CENTRAL HEATING GAS APPLIANCE — A gas appliance normally used as the primary means of heating premises. Ordinarily this includes gas boilers, warm air furnaces, and floor furnaces, but does not include unit heaters, room or space heaters, nor industrial gas boilers.

CHIMNEY — A vertical masonry or reinforced concrete shaft containing one or more flues or vents.

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 gas.

COMBINATION RANGE (SEE BUNGALOW RANGE) — A range which may be operated on both gas and supplementary fuel (coal, wood, oil, kerosene, or gasoline), and consisting of a top burner and oven section which may be heated by either or both gas or supplementary fuel.

COMBUSTIBLE CONSTRUCTION — By combustible construction is meant a combustible wall or combustible surface constructed of wood, composition, or of wooden studding and lath and plaster.

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.

CONCEALED GAS PIPING — Gas piping which, when in place in the finished building, will be hidden from view by the structure.

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

CONTROL — A device designed to regulate the gas, air, water and electrical supply to a gas appliance. It may be manual or automatic.

CONTROL COCK — A cock used in piping to control the gas supply to any section of a system of piping or to an appliance.

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

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

DEMAND — The maximum amount of gas required per unit of time, usually expressed in cu. ft. per hour, or BTU per hour, required for the operation of the appliance or appliances supplied.

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 flue or vent connector from an appliance which is designed to (1) insure the ready escape of the products of combustion 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 flue or vent upon the operation of the appliance.

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

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 OR VENT — A conduit or passageway, vertical or nearly so, for conveying flue gases to the outer air.

FLUE COLLAR — That portion of an appliance designed for the attachment of the draft hood or flue or vent connector.

FLUE OR VENT CONNECTOR — The pipe connecting an appliance with the flue or vent. This corresponds to the smoke pipe used with solid or liquid fuels.

FLUE GASES — Products of combustion and excess air.

FUEL LINE — The independent pipe inside a building from the meter or source of supply to an appliance or appliances.

FURNACE — A self-contained gas-burning appliance for heating air by secondary transfer of heat from the flue gases through metal to the air, usually located outside of the room or rooms being heated.

a. GRAVITY TYPE WARM AIR FURNACE — A furnace depending primarily upon circulation of air by gravity. This classification shall

also include 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. FORCED AIR TYPE WARM AIR FURNACE — A furnace equipped with a fan which provides the primary means for circulation of air and of sufficient capacity to deliver air at a temperature rise of not more than 100° F., above room temperature when operating against an imposed static pressure of 0.2 in. equivalent water column with the furnace operating at its rated BTU input capacity.

GAS HOSE — A gas conduit which depends for tightness on joint packing, or on any wall structure other than that formed by a continuous one-piece metal tubing member.

GRAVITY — (See SPECIFIC GRAVITY.)

HEATING VALUE (TOTAL) — The number of British Thermal Units produced by the combustion at constant pressure, of 1 cu. ft. 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.

HOTEL AND RESTAURANT RANGE — A gas appliance of the floor type providing for top cooking, roasting, baking or broiling, or any combination of top cooking with any of these other functions and not designed specifically for domestic use.

HOUSE PIPING — The same as FUEL LINE.

HOUSE RISER — The principal vertical pipe inside a building which conducts the gas from the meter or source of supply to the different floors of the building.

INCINERATOR — An appliance used to reduce refuse material to ashes, and which is sold as a complete unit.

a. PORTABLE INCINERATOR — An incinerator which is a complete unit in itself, and which does not become an integral part of the structure in which it is installed.

b. WALL INCINERATOR — An incinerator which is a complete unit in itself, designed to be installed in a fireproof wall or chimney, thereby becoming an integral part of the structure in which it is installed.

INDIVIDUAL MAIN BURNER VALVE — A valve which controls the gas supply to an individual main burner.

INDUSTRIAL GAS BOILER — A gas appliance designed primarily to furnish steam for use in some process the nature of which is industrial or commercial, as distinguished from central heating. This definition, therefore, does not apply to any boiler covered by the American Standard Approval Requirements for Central Heating Gas Appliances.

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 APPLIANCE OR ACCESSORY — (See Section 4, USE OF APPROVED APPLIANCES.)

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.

MAIN BURNER CONTROL VALVE — A valve which controls the gas supply to the main burner manifold.

MANIFOLD — The conduit of an appliance which supplies gas to the individual burners.

MANUAL MAIN SHUT-OFF VALVE — A manually operated valve or cock 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 shut-off valves.

MEASURED GAS — Gas which has passed through and the volume of which has been registered by a meter.

METER — The instrument installed to measure the volume of gas delivered through it.

MIXER — The combination of mixer head, mixer throat and mixer tube.

a. MIXER HEAD — That 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 and 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.

PIPE OR PIPING — Includes pipe and tubing.

PRIMARY AIR — The air introduced into a burner and which mixes with the gas before it reaches the port or ports.

PURGE — To free a gas conduit of air, gas, or a mixture of gas and air.

RECESSED HEATER — A self-contained appliance, complete with grilles or equivalent, designed for incorporation in or permanent attachment to a wall, floor, ceiling or partition, either taking air for combustion

from the space to be heated, or having a sealed combustion system, the inlet and outlet of which communicates only with the outside air, 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. Where such boots are provided, they shall be supplied by the manufacturer, as an integral part of the appliance and tested as such. This definition shall exclude floor furnaces, unit heaters and central furnaces as herein defined.

1. GRAVITY TYPE RECESSED HEATER — A recessed heater depending on circulation of air by gravity.
2. FAN TYPE RECESSED HEATER — A recessed heater equipped with a fan.

REGULATOR — A device for controlling and maintaining a uniform gas supply pressure.

RELIEF DEVICE — A safety device designed to forestall the development of a dangerous condition in the medium being heated, by relieving either pressure, temperature, or vacuum built-up in the appliance.

a. PRESSURE RELIEF VALVE — An automatic device which opens or closes a relief vent, depending on whether the pressure is above or below a predetermined value.
b. TEMPERATURE RELIEF VALVE —
    1. FUSIBLE PLUG TYPE — A device which opens and keeps open a relief vent by the melting or softening of a fusible plug or cartridge at a predetermined temperature.
    2. RESEATING OR SELF-CLOSING TYPE — An automatic device which opens and closes a relief vent, depending on whether the temperature is above or below a predetermined value.
c. VACUUM RELIEF VALVE — An automatic device which opens or closes a relief vent, depending on whether the vacuum is above or below a predetermined value.

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 OR SPACE HEATER — A self-contained gas-burning appliance installed in and for heating rooms. This definition shall not include unit heaters, central heating gas appliances, nor garage heaters.

SECONDARY AIR — The air externally supplied to the flame at the point of combustion.

SEMI-RIGID TUBING — A gas conduit having semi-flexible metal wall structure.

SERVICE PIPE — The pipe which brings the gas from the gas main to the meter.

SHUT-OFF — (See CONTROL COCK.)

SMOKE PIPE — (See FLUE OR VENT CONNECTOR.)

SPECIFIC GRAVITY — As applied to gas, specific gravity is the ratio of weight of a given volume to that of the same volume of air, both measured under the same conditions.

THERMOSTAT — An automatic device actuated by temperature changes, designed to control the gas supply to a burner, or burners, in order to maintain temperatures between predetermined limits.

TYPE A FLUE OR VENT — Flues or vents of masonry, reinforced concrete, or metal smoke stacks.

TYPE B GAS FLUE OR VENT — Vent piping of noncombustible, corrosion-resistant material of sufficient thickness, cross-sectional area, and heat insulating quality to avoid excess temperature on adjacent combustible material and certified by a nationally recognized testing agency.

TYPE C GAS FLUE OR VENT — Flue or vent piping of sheet copper of not less than No. 24 U. S. Standard Gauge or of galvanized iron of not less than No. 20 U. S. Standard Gauge, or of other approved corrosion-resistant material.

UNIT HEATER — A self-contained gas-burning appliance of the fan type, designed for the delivery of warm air directly into the space in which the appliance is located.

UNMEASURED GAS — Gas which has not passed through and the volume of which has not been registered by a meter.

VENT — (See Definition of FLUE OR VENT.)

WALL HEATER, UNVENTED OPEN-FLAME RADIANT TYPE — A room heater of the open front type, designed for insertion in or attachment to a wall or partition, having fully exposed flames, the heat from which is reflected by ceramic radiants or a metal, asbestos, clay back or equivalent backwall reflecting surface. It incorporates no concealed venting arrangements in its construction and discharges all products of combustion through the open front into the room being heated.

WATER HEATERS —

a. AUTOMATIC INSTANTANEOUS — The type which heats the water as it is drawn.
b. AUTOMATIC STORAGE — The type which combines a water heating element and water storage tank, gas to the main burner being controlled by a thermostat.
c. CIRCULATING OR TANK — Manually controlled type usually connected to the ordinary hot water tank.