CODE

FOR THE INSTALLATION OF

HEAT PRODUCING APPLIANCES,

HEATING, VENTILATING,

AIR CONDITIONING,

BLOWER and EXHAUST SYSTEMS

Recommended by the
NATIONAL BOARD OF FIRE UNDERWRITERS
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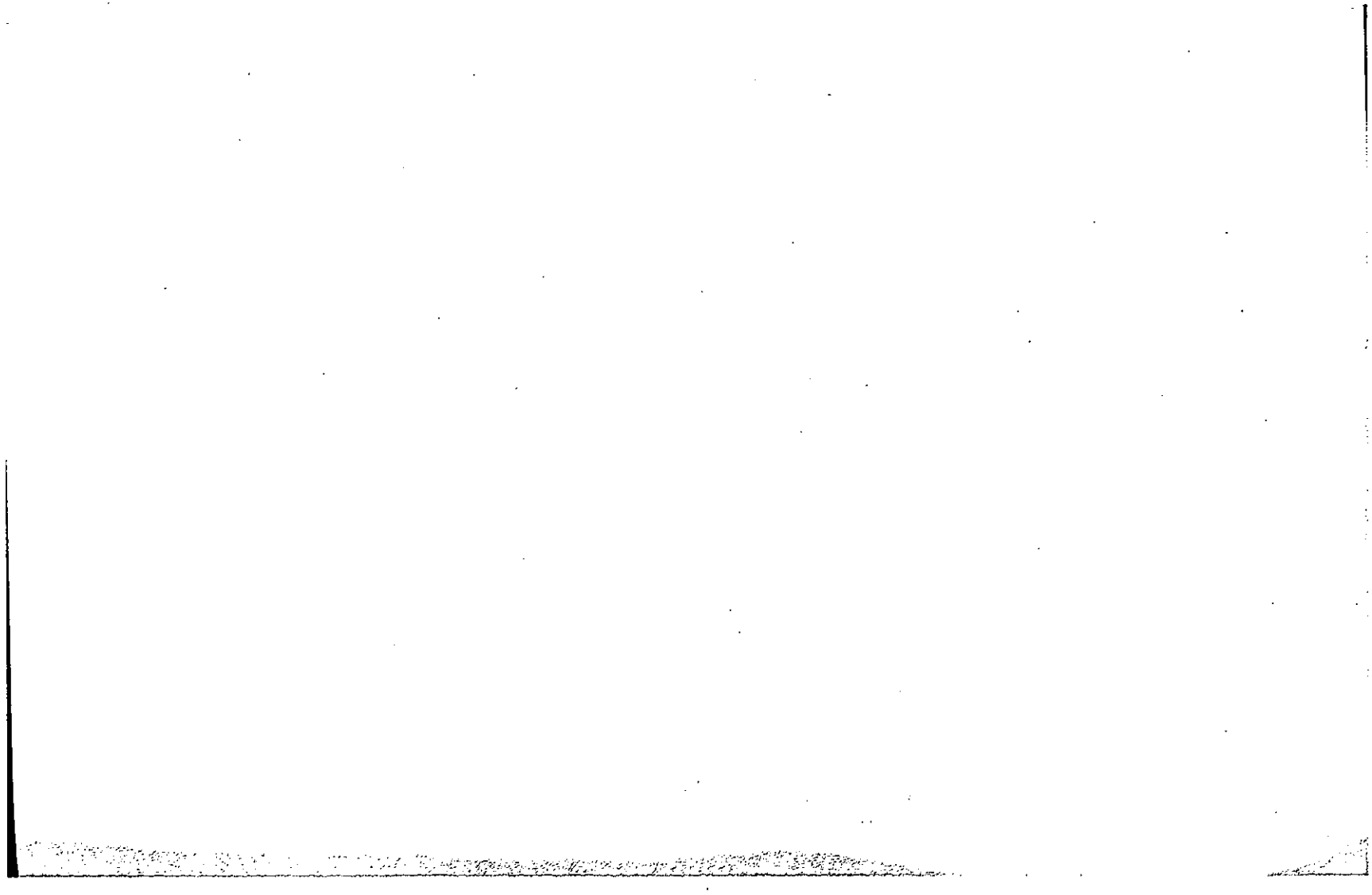

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SECTION 1. GENERAL REQUIREMENTS AND DEFINITIONS.

1.1. Accessibility.

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1.2. Air for combustion.

Suitable provision shall be made where necessary for intake of air needed for combustion of fuel burning appliances.

1.3 Definitions.

Attic furnace. See section 2.1.

Central furnace. See section 2.1.

Central warm air heating system. See section 12.2.

Combustible material as pertaining to materials adjacent to or in contact with heat producing appliances, flue pipes and vent connectors, steam and hot water pipes, and warm air ducts means material made of or surfaced with wood, compressed paper, plant fibers or other material that will ignite and burn. Such material shall be considered as combustible even though flameproofed, fire retardant treated, or plastered. Gypsum or other wallboards that are surfaced with combustible material are classified as combustible.

Downflow furnace. See section 2.1.

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Forced warm air furnace. See section 2.1.

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Vent connector means a pipe connecting a gas burning appliance to a gas vent or to a chimney.

Wall heater. See section 6.1.

SECTION 2. HEATING FURNACES AND BOILERS.

2.1. Definitions.

(a) **Heating furnaces and boilers** shall include central furnaces, hot water boilers operating at not in excess of 250 F., steam boilers operating at not in excess of 15 pounds gauge pressure and floor mounted unit heaters, used for heating of buildings or structures.

(b) **Central furnace** means a self-contained, flue connected or vented appliance intended primarily to supply heated air through ducts to spaces remote from or adjacent to the appliance location as well as to the space in which it is located.

(c) **Forced warm air furnace** means a furnace equipped with a blower which provides the primary means for circulation of air;

attic furnace means a forced warm air furnace designed specifically for installation in an attic or in a space with low headroom, normally unoccupied;

downflow furnace means a forced warm air furnace designed with air flow through the furnace essentially in a vertical path, discharging air at or near the bottom of the furnace;

duct furnace means a furnace designed for insertion or installation in a duct of an air distribution system to supply warm air for heating and which depends for air circulation on a blower not furnished as a part of the furnace.

(d) **Gravity furnace** means a central furnace depending primarily on circulation of air by gravity.

(e) **Unit heater**—See section 5.1.

(f) Devices referred to as "such that flame or hot gases do not come in contact with the base" include conventional type heating furnaces and boilers having an ash pit or similar space beneath the burning fuel (whether gas, liquid or solid) and like devices in which the base is not directly exposed to the flame or the products of combustion.

2.2. Mounting.

(a) Furnaces and boilers, except as provided in paragraphs (b), (c), (d), (e), (f) and (g) of this section 2.2., shall be mounted on the ground, or 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 extend not less than 12 inches beyond the appliance on all sides, and where solid fuel is used, it shall extend not less than 18 inches at the front or side where ashes are removed.

(b) Furnaces and boilers that are approved specifically for installation on a floor constructed of combustible material may be mounted in accordance with the conditions of such approval.

(c) Forced warm air furnaces may be mounted on floors other than as specified in paragraph 2.2(a), provided they are so arranged that the fan chamber occupies the entire area beneath the firing chamber and forms a well ventilated air space between the firing chamber and the floor of not less than 18 inches in height with at least one metal baffle between the firing chamber and the floor.

(d) Heating boilers of the water-base type may be mounted on floors other than as specified in paragraph 2.2(a), provided the water chamber extends under the whole of the ash pit and the firebox, or under the whole of the firing chamber if there is no ash pit. If solid fuel is used see paragraph 2.2(h).

(e) Heating furnaces and boilers 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 2.2(a), 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 of an inch thick covered with sheet metal of not less than 24 gauge. The above specified floor protection shall extend not less than 6 inches beyond the appliance on all sides, except that where the appliance is approved in accordance with paragraph 2.3(b) for a clearance of less than 6 inches to a combustible wall, the specified floor protection shall extend either to the wall or out for a distance of 6 inches whichever is the lesser distance. If solid fuel is used see paragraph 2.2(h).

(f) Heating furnaces and boilers may be mounted on floors other than as specified in paragraph 2.2(a), 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 hollow masonry not less than 4 inches thick covered with sheet metal of not less than 24 gauge. Such masonry shall be laid with ends unsealed and points matched in such a way as to provide a free circulation of air from side to side through the masonry. If solid fuel is used see paragraph 2.2(h).

(g) Heating furnaces and boilers which are arranged so that flame or hot gases come in contact with the base may be mounted on floors other than as specified in paragraph 2.2(a), provided the floor under the appliance is protected by two courses of 4-inch hollow masonry, with courses laid at right angles and with ends

Table 2.3(a).

Clearances to Combustible Material for Furnaces, Boilers and Heat Exchangers Installed in Rooms Which Are Large in Comparison With Size of Appliance Except as Provided in Paragraph 2.3(a)(1).

	Minimum Clearance, Inches				
	Above and Sides of Bonnet or Plenum	Jacket Sides and Rear	Front See Note 1	Projecting Flue Box or Draft Hood	Flue Pipe or Vent Connector
I. Automatically fired, forced air or gravity furnace, equipped with 250°F temperature limit control installed in accordance with Note 2.					
Burning liquid fuel	16	6	24	18[5]	18[5]
Burning gas fuel	16	6	18	9[4]	9[4]
Utilizing electricity	16	6	18	—	—
II. Automatically fired, forced air or gravity furnace, equipped with limit control not conforming to Note 2, but has been tested by an approved agency and found to have outlet air temperature not exceeding 250°F.					
Burning liquid fuel	2	6	24	18[5]	18[5]
Burning gas fuel	2	6	18	6	6
Utilizing electricity	2	6	18	—	—
III. Steam or Hot Water Heat Exchanger—Steam not over 15 pounds gauge pressure and hot water not more than 250°F.	1	1	1	—	—
IV. Automatically stoker fired, forced air system equipped with 250°F temperature limit control installed in accorddance with Note 2 and barometric draft control. See Note 3.					
Burning solid fuel	6	6	48	18	18
V. Heating Boilers—Steam boilers operating at not over 15 pounds gauge pressure and hot water boilers operating at not in excess of 250°F of the water-wall type or having a jacket or lining of masonry or other satisfactory material.					
Burning liquid fuel	6	6	24	18[5]	18[5]
Burning gas fuel	6	6	18	9[4]	9[4]
Burning solid fuel	6	6	48	18	18
VI. Furnaces and Boilers, other than above.					
Burning liquid fuel	18	18	48	18	18
Burning gas fuel	18	18	18	9[4]	9[4]
Burning solid fuel	18	18	48	18	18

Notes:

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

2. Limit control that has been tested by an approved agency and that cannot be set higher than 250 F. installed not more than 10 inches above the top surface of the heat exchanger in a supply plenum that extends at least 12 inches above the top surface of the heat exchanger.

3. Barometric draft control operated by draft intensity and permanently set to limit the draft to a maximum intensity of 0.13 inches of water gauge.

4. This clearance may be reduced to 6 inches for gas burning furnaces and boilers that have been tested by an approved agency and found to have flue gas temperatures not exceeding 550 F. This clearance does not apply to approved Type B gas vents used and installed in accordance with the conditions of such approval.

5. For liquid fuel burning furnaces and boilers that are approved specifically for installation with lesser clearances flue pipes may be installed in accordance with the conditions of such approval.

6. If limit control cannot be set higher than 250 F. but note 2 is not otherwise complied with, this clearance shall be 6 inches.

unsealed and joints matched in such a way as to provide a free circulation of air through each masonry course. Such masonry shall be covered with a steel plate not les than 3/16 of an inch thick. If solid fuel is used see paragraph 2.2(h).

(h) In all cases where heating furnaces and boilers burning solid fuel are mounted on floors other than as specified in paragraph 2.2(a), the floor for not less than 18 inches beyond the front of the appliance or side where ashes are removed shall be protected with asbestos millboard not less than ¼ of an inch thick covered with sheet metal of not less than 24 gauge, or with protection equivalent thereto.

2.3. Clearances.

(a) Heating furnaces and boilers installed in rooms which are large in comparison with the size of the appliance, except as provided in paragraphs (1), (2), and (3) below, shall be installed to provide clearances to woodwork or other combustible material not less than as shown in Table 2.3(a). Floor mounted unit heaters shall be installed with clearances as required in Table 2.3(a) for appliances of similar heat producing characteristics and with similar controls.

(1) Heating furnaces and boilers that have been tested by an approved testing agency and found to require clearances greater than specified in Table 2.3(a) shall be installed with such clearances unless protected as specified in paragraph (3) of this section 2.3(a).

(2) Heating furnaces and boilers that are approved specifically for installation with clearances less than specified in Table 2.3(a) may be installed in accordance with the conditions of such approval.

(3) Heating furnaces and boilers may be installed in rooms, but not in confined spaces such as alcoves or closets, with re-

Table 2.3(b).
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. 2.3). Thicknesses are minimum.	Where the required Clearance with no protection is:											
	36 inches			18 inches			12 inches		9 inches	6 inches		
	Above	Sides & Rear	Flue Pipe	Above	Sides & Rear	Flue Pipe or Vent Connector	Above	Sides & Rear	Flue Pipe or Vent Connector	Above	Sides & Rear	Flue Pipe or Vent Connector
(a) ¼ in. asbestos millboard spaced out 1 in.†	30	18	30	15	9	12	9	6	6	3	2	3
(b) 28 gauge sheet metal on ¼ in. asbestos millboard	24	18	24	12	9	12	9	6	4	3	2	2
(c) 28 gauge sheet metal spaced out 1 in.†	18	12	18	9	6	9	6	4	4	2	2	2
(d) 28 gauge sheet metal on ⅛ in. asbestos millboard spaced out 1 in.†	18	12	18	9	6	9	6	4	4	2	2	2
(e) 1½ in. asbestos cement covering on heating appliance	18	12	36	9	6	18	6	4	9	2	1	6
(f) ¼ in. asbestos millboard on 1 in. rockwool bats reinforced with wire mesh or equivalent	18	12	18	6	6	6	4	4	4	2	2	2
(g) 22 gauge sheet metal on 1 in. rockwool bats reinforced with wire or equivalent	18	12	12	4	3	3	2	2	2	2	2	2
(h) ¼ in. asbestos cement board or ¼ in. asbestos millboard	36	36	36	18	18	18	12	12	9	4	4	4
(i) ¼ in. 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 but in no case shall the clearance be such as to interfere with the requirements for combustion air and for accessibility.

For the protection described in (e), the clearance shall be measured from the outer surface of the protective covering to the combustible material.

† Spacers shall be of noncombustible material.

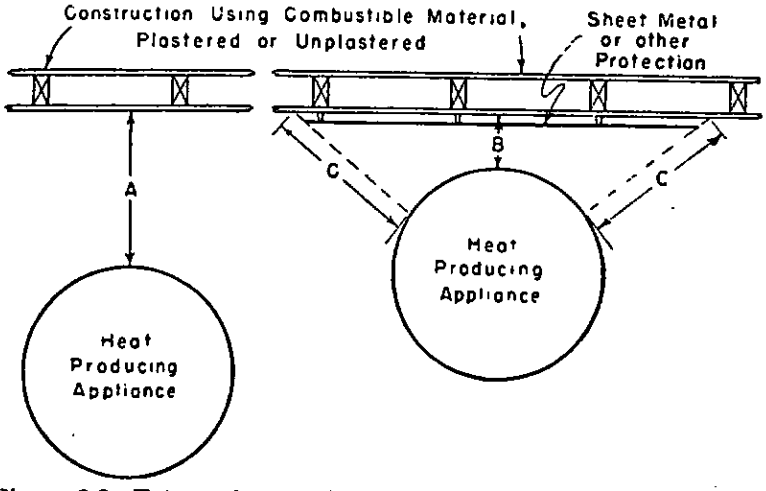

Figure 2.3. Extent of protection required to reduce clearances from heating appliances, flue pipes or vent connectors.

A equals the required clearance with no protection, specified in Tables 2.3(a) and 3.3 and in the sections applying to the various types of appliances.

B equals the reduced clearance permitted in accordance with Table 2.3(b). The protection applied to the construction using combustible material shall extend far enough in each direction to make C equal to A.

duced clearances to woodwork or other combustible material or the appliance is protected as described in Table 2.3(b).

(b) Heating furnaces and boilers shall not be installed in confined spaces such as alcoves or closets unless they have been approved specifically for such installation and are installed in accordance with the conditions of such approval. Installation clearances for furnaces and boilers in confined spaces shall not be reduced by protection methods described in Table 2.3(b).

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

2.4. **Controls.**

(a) Temperature limit controls. Temperature limit controls shall be of an approved type and shall be such that they cannot be set higher than the specified temperature setting.

(b) Fan control for stoker-fired furnaces. When a warm air furnace that is equipped with a fan to circulate the air is stoker-fired, the furnace shall also be equipped with an automatic over-run control to start the fan when the air in the furnace bonnet or at the beginning of the main supply duct at a point not affected

by radiated heat reaches a temperature not higher than 200 F. after the stoker and fan (in its normal operation) have been shut down as a result of a satisfied thermostat. If a manual disconnect is installed in the air circulating fan electrical circuit, it shall be so installed as to de-energize simultaneously both the fan and the stoker.

2.5. Attic furnaces.

(a) Heating furnaces shall not be installed in attics unless they are of a type that has been approved specifically for such installation.

(b) Attic furnaces shall be installed in accordance with the mounting and clearance provisions of sections 2.2 and 2.3.

2.6. Downflow furnaces.

(a) Requirements. Downflow furnaces shall be automatically operated gas or liquid fuel burning or electric furnaces that are equipped with approved temperature limit controls that will limit outlet air temperature to 200 F. Downflow furnaces shall be designed to prevent unsafe temperatures in the event of reverse flow.

(b) Mounting.

(1) Downflow furnaces shall not be mounted on floors other than specified in paragraph 2.2(a), unless the appliance rests upon hollow masonry not less than 4 inches thick. Such masonry units shall be laid with ends unsealed and joints matched in such a manner as to allow circulation of air through the masonry. See figure 2.6.

(2) Downflow furnaces that are approved specifically for installation on a floor constructed of combustible material may be mounted in accordance with the conditions of such approval.

(3) Downflow furnaces shall be installed so that there are no open passages in the floor through which flame or hot gases from a fire originating in the space below the floor can travel to the room above.

(c) Clearances. Downflow furnaces shall be installed in accordance with clearance provisions of section 2.3.

2.7. Duct furnaces.

(a) Support. Duct furnaces shall be firmly supported.

(b) Clearances. Duct furnaces, except as provided in paragraphs (c) and (e) of this section 2.7, shall be installed with clearances of at least 6 inches to adjacent walls, ceilings and floors constructed of combustible material.

(c) Duct furnaces that are approved specifically for installation with lesser clearances than specified in paragraph 2.7(b) may be installed in accordance with the conditions of such approval.

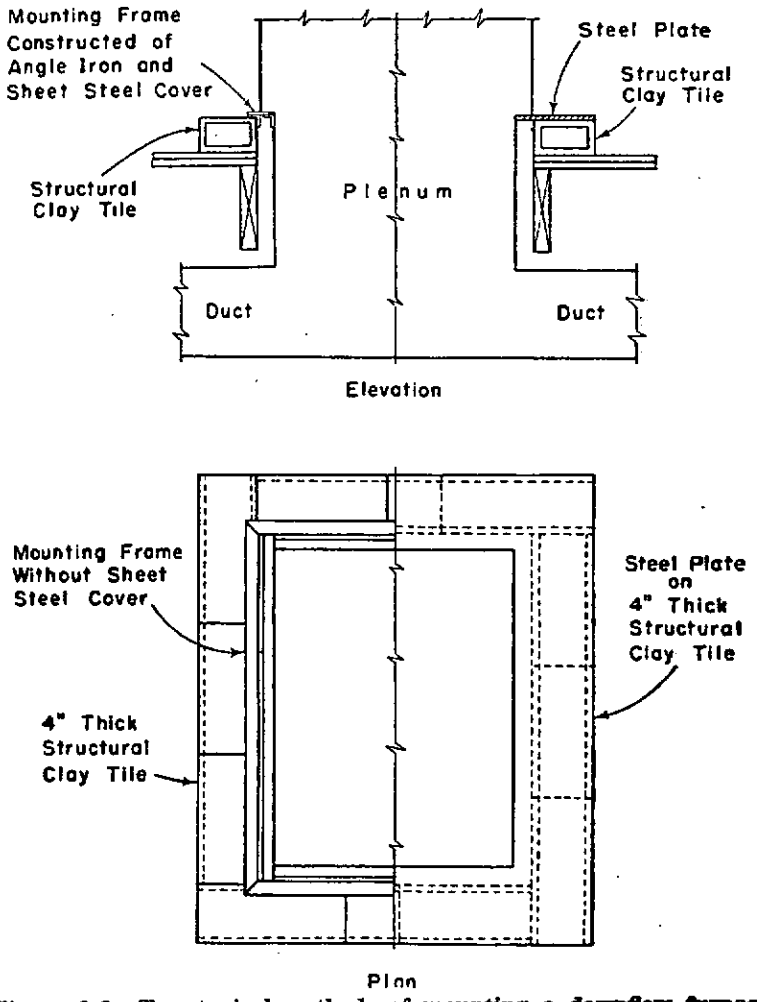

Figure 2.6. Two typical methods of mounting a downflow furnace on a floor constructed on combustible material.

(d) Duct furnace flue pipes, except as provided in paragraph 2.7(e), shall be installed to provide clearances to woodwork or other combustible material not less than 18 inches. Vent connectors for such appliances, except as provided in paragraphs (e) and (f) of this section 2.7, shal be installed to provide clearances to combustible material not less than 9 inches.

(e) Duct furnaces and their flue pipes or vent connectors may be installed in rooms, but not in confined spaces such as alcoves or closets, with reduced clearances to woodwork or other combustible material, provided the combustible material is protected as described in Table 2.3(b).

(f) Gas burning duct furnaces that have been tested by an approved agency and found to have flue gas temperatures not exceeding 550 F. may be installed with clearance to woodwork or other combustible material from metal flue or vent connectors of 6 inches, and from approved type B gas vents the clearance may be reduced in accordance with the conditions of such approval.

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

(h) Controls. Controls shall be located outside the duct except for the sensing element of a control.

2.8. Hand-fired solid fuel burning furnaces.

(a) Thermostatically controlled furnaces. Hand-fired solid fuel burning furnaces in which the furnace draft is controlled by a thermostat shall be equipped with (1) a fail safe 250 F. limit control that is installed not more than 10 inches above the top surface of the heat exchanger in a supply plenum that extends at least 12 inches above the top surface of the heat exchanger, and (2) a barometric draft control that is operated by draft intensity and is permanently set to limit the draft to a maximum intensity of 0.13 inches of water gauge. By a fail safe limit control is meant one that will automatically check the furnace in the event of power failure or shut off, or that will automatically check the furnace when 250 F. temperature is reached whether or not power is then available.

(b) Air circulating fan controls. When a hand-fired solid fuel burning furnace is equipped with a fan to circulate the air, the furnace shall be equipped with fan controls as required for stoker fired furnaces by paragraph 2.4(b).

SECTION 3. HEATING AND COOKING APPLIANCES.

3.1. Definitions.

(a) **Floor mounted heating and cooking appliances** shall include domestic type cooking stoves and ranges, laundry stoves, room heaters (heating stoves), gas-steam or gas-hot water radiators, and water heaters, of types designed for mounting on the floor, and such other appliances as may be so classified by the building official.

(b) **Room heaters** mean above-the-floor devices for direct heating of the space in and adjacent to that in which the device is located, without external heating pipes or ducts.

(c) **Restaurant type cooking appliances.** See section 7.1.

3.2. Mounting.

(a) Floor mounted heating and cooking appliances, except as provided in paragraphs (b), (c), (d) and (e) of this section 3.2, shall be mounted on the ground or on floors of fire-resistive con-

struction with noncombustible flooring and surface finish, 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 6 inches beyond the appliance on all sides, and where solid fuel is used shall extend not less than 18 inches at the front or side where ashes are removed.

(b) Floor mounted heating and cooking appliances that are approved specifically for installation on a floor constructed of combustible material may be mounted in accordance with the conditions of such approval.

(c) Floor mounted heating and cooking appliances which are set on legs or simulated 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 3.2(a), provided the floor under the appliance is protected with sheet metal of not less than 24 gauge, or by other approved noncombustible material. Where solid fuel is used, the protection shall extend not less than 18 inches beyond the appliance at the front or side where ashes are removed. With radiating type gas burning room heaters which make use of metal, asbestos or ceramic material to direct radiation to the front of the device, the floor protection shall extend out at the front not less than 36 inches when the heater is not of a type approved for installation on a combustible floor.

(d) Floor mounted heating and cooking appliances which are set on legs that provide not less than 18 inches open space under the base of the appliance, or which have no burners and no portion of any oven or broiler within 18 inches of the floor, may be mounted on floors other than as specified in paragraph 3.2(a) without special floor protection, provided there is at least one sheet metal baffle between the burners and the floor.

(e) Floor mounted heating and cooking appliances may be mounted on floors other than as specified in paragraph 3.2(a), provided the floor under the appliance is protected with hollow masonry not less than 4 inches thick covered with sheet metal of not less than 24 gauge. Such masonry 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. Where solid fuel is used, the floor for 18 inches beyond the front of the appliance or side where ashes are removed shall be protected with sheet metal of not less than 24 gauge, or with protection equivalent thereto.

3.3. Clearances.

(a) Floor mounted heating and cooking appliances, except as provided in paragraphs 3.3(b) and (c), shall be installed to provide clearances to woodwork or other combustible material not less than as shown in Table 3.3.

(b) Floor mounted heating and cooking appliances that are approved specifically for installation with lesser clearances than

Table 3.3.

Clearances to Combustible Material.

Floor Mounted Heating and Cooking Appliances	Minimum Clearance—Inches Sides and Rear	Flue Pipe or Vent Connector
Domestic type ranges and cooking stoves.		
Burning solid fuel in firepot without fire clay lining	36[1]	18
Burning solid fuel in firepot with fire clay lining	24[1]	18
Burning liquid fuel	24[1]	18[2]
Burning gas fuel	6	6[3]
Room heaters (heating stoves) circulating type.[5]		
Burning solid fuel	12	18
Burning liquid fuel	12	18[2]
Burning gas fuel	12	9[4]
Room heaters (heating stoves), heat radiating or other than circulating type.		
Burning solid fuel	36	18
Burning liquid fuel	36	18[2]
Burning gas fuel	18[6]	9[4]
Water heaters[7] and laundry stoves.		
Burning solid fuel	12	18
Burning liquid fuel	12	18[2]
Burning gas fuel	12	9[4]
Gas-steam and gas-hot water radiators	6	6[3]

Notes:

1. For other than the fire box side of a range burning solid fuel or the burner side of a range burning liquid fuel, the clearance at sides and rear may be 18 inches.

2. For liquid burning appliances that are approved specifically for installation with lesser clearances, flue pipes may be installed in accordance with the conditions of such approval.

3. This clearance does not apply to approved type B gas vents used and installed in accordance with the conditions of such approval.

4. This clearance may be reduced to 6 inches for gas burning appliances that have been tested by an approved agency and found to have flue gas temperatures not exceeding 550 F. This clearance does not apply to approved Type B gas vents that are used and installed in accordance with conditions of such approval.

5. A circulating type room heater is a room heater that has an outer jacket surrounding the casing around the combustion chamber, arranged with openings at top and bottom so that air circulates between the inner casing and the outer jacket. Room heaters that have openings in the outer jacket to permit some direct radiation from the inner casing shall be classed as radiating type.

6. Radiating type room heaters burning gas 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; those which have a double back of metal or ceramic material may be installed with clearance of 18 inches at sides and 12 inches in rear.

7. Combination heating stoves and water heaters shall be considered as room heaters.

specified in paragraph 3.3(a) may be installed in accordance with the conditions of such approval.

(c) Floor mounted heating and cooking appliances may be installed in rooms, but not in confined spaces such as alcoves or closets, with reduced clearances to woodwork or other combustible material, provided the combustible material or the appliance is protected as described in Table 2.3(b).

(b) Cooking stoves and ranges and room heaters shall have a clearance vertically above the top of not less than 36 inches to woodwork or other combustible material, provided that when the underside of such combustible material is protected with asbestos millboard at least ¼ of an inch thick covered with sheet metal of not less than 28 gauge, the distance shall be not less than 2 feet. The protection shall extend 9 inches beyond the sides of the appliance.

(e) Liquid fuel burning, floor mounted heating and cooking appliances which have a fuel tank attached thereto shall in all cases be installed with sufficent clearance to provide direct and easy access to the fuel tank.

3.4 Room heater in sleeping quarters and in institutional occupancies.

Room heaters installed in sleeping quarters for use of transients or installed at any location in an institutional occupancy shall be of the vented type and shall be connected to an effective flue or vent. Gas burning room heaters shall be equipped with an automatic pilot.

SECTION 4. FLOOR FURNACES.

4.1. Definition. Floor furnace means a self-contained flue connected or vented unit furnace designed to be suspended from the floor of the space being heated, taking air for combustion outside this space, and with means for observing flame and lighting the appliance from such space.

4.2. Installation.

(a) Floor furnaces shall not be installed in floors constructed of combustible material unless approved specifically for such installation and installed in accordance with the conditions of such approval.

(b) Support. The floor around the floor furnace shall be braced and headed with a framework of material not lighter than the joists. Floor furnaces shall be supported independently of the floor grills.

(c) Clearances. The bottoms of floor furnaces shall have at least 6 inches clearance from the ground. Where the ground must be excavated to provide this clearance, the excavation shall extend at least 12 inches beyond the furnace on all sides and not

less than 18 inches on the control side. Where such excavation exceeds 12 inches or the ground contour and ground moisture conditions are such that water may come to within 6 inches of the bottom of the floor furnace, a water-tight, properly anchored pan constructed of copper, galvanized iron, or other suitable corrosion resistant material, or a waterproof concrete pit shall be provided under the furnace. Sides of pan or pit shall extend 4 inches above ground level.

(d) Access. Floor furnaces shall be made readily accessible. Openings in foundation walls and trap doors in floors shall be not smaller than 18 by 24 inches. Under-floor passageways to the furnace shall be not less than 18 inches high by 24 inches wide.

(e) Location of thermostat. A thermostat controlling a floor furnace 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.

(f) Upper floor installation. Floor furnaces shall not be installed in an upper floor of any building except that approved floor furnaces may be installed in upper floors, provided the furnace assembly projects below into a utility room, closet, garage or similar non-habitable space. In upper floor installations the furnace shall be enclosed completely (entirely separated from the non-habitable space) with means for air intake, with access facilities for servicing on the control side, with minimum furnace clearance 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.

(g) Placement. No floor furnace shall be installed in the floor of any aisle or passageway of any auditorium, public hall or place of assembly or in an exit way from any such room or space.

(h) With the exception of wall-register models, floor furnaces shall not be placed closer than 6 inches to the nearest wall. Wall-register models shall not be placed closer than 6 inches to a corner.

(i) Floor furnaces 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.

4.3. Clearances for flue pipes and vent connectors.

(a) Floor furnace flue pipes and vent connectors, except as provided in paragraphs 4.3(b) and (c), shall be installed to provide clearances to woodwork or other combustible material not less than 9 inches.

(b) In the case of approved gas burning floor furnaces, the clearance from approved type B gas vent connectors to woodwork or other combustible material may be reduced in accordance with the conditions of such approval, provided that such clearance shall be not less than 3 inches for a distance of not less than

3 feet from the outlet of the draft hood measured along the center line of the vent connecter.

(c) Floor furnace flue pipes and vent connectors may be installed with lesser clearances to woodwork or other combustible material provided the combustible material is protected as described in Table 2.3(b).

SECTION 5. UNIT HEATERS.

5.1. Definitions.

(a) **Unit heater** means a self-contained, automatically controlled heating appliance, intended for heating of nonresidential space in which it is installed, equipped with an integral means for circulation of air.

(b) **Steam or hot water unit heater** means a unit heater in which the heating element is supplied heat from a steam or hot water system.

(c) **Suspended type unit heater** means a unit heater which is suspended from the ceiling or mounted between uprights, or mounted on wall or column brackets.

(d) **Floor mounted unit heater** means a unit heater which is mounted on the floor of the space to be heated.

5.2. Floor mounted unit heaters.

Floor mounted unit heaters shall be installed as provided in section 2, Heating Furnaces and Boilers.

5.3. Suspended type unit heaters.

(a) Suspended type, unit heaters shall be safely and adequately supported with due consideration given to their weight and vibration characteristics. Hangers, brackets and other such supports shall be of noncombustible material.

(b) Suspended type, gas or liquid fuel burning or electric unit heaters, except as provided in paragraphs 5.3(c) and (d), shall be installed to provide a clearance in any direction to woodwork or other combustible material of not less than 18 inches. The clearance from the flue pipe of such an appliance burning liquid fuel shall be not less than 18 inches to combustible material. The clearance from the vent connector of such an appliance burning gas shall be not less than 9 inches to combustible material, except that from vertical gas vent the clearance may be 6 inches, and approved type B gas vents may be used and installed in accordance with the conditions of such approval.

(c) Suspended type, gas or liquid fuel burning or electric unit heaters that are approved specifically for installation with lesser clearances than specified in paragraph 5.3(b) may be installed in accordance with the conditions of such approval.

(d) Suspended type, gas or liquid fuel burning unit heaters and their flue pipes or vent connectors, and electric unit heaters may be installed with lesser clearances to woodwork or other combustible material, provided the combustible material is protected as described in Table 2.3(b).

(e) Suspended type, gas or liquid fuel burning or electric unit heaters shall not be attached to a warm air duct system unless approved specifically for such installation and installed in accordance with the conditions of such approval.

5.4. Steam or hot water unit heaters.

Steam or hot water unit heaters shall be installed to provided clearances from all heated protions thereof to woodwork or other combustible material of not less than one inch.

SECTION 6. RECESSED HEATERS AND WALL HEATERS.

6.1. Definition.

Recessed heaters and wall heaters mean self-contained heating appliances designed for incorporation in or permanent attachment to a wall, partition, floor or ceiling of the room being heated.

6.2. Installation.

(a) Recessed heaters and wall heaters shall not be installed in or attached to walls, partitions, floors or ceilings constructed of combustible material unless approved specifically for such installation and installed in accordance with the conditions of such approval.

(b) Recessed heaters and wall heaters shall be so located as not to cause a fire hazard to walls, floors, curtains, furniture and doors.

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

SECTION 7. RESTAURANT TYPE COOKING APPLIANCES.

7.1. Definition.

(a) **Restaurant type cooking appliances** shall include ranges, ovens, broilers, and other miscellaneous cooking appliances, of the types designed for use in restaurant and hotel kitchens.

(b) **Counter type appliances** shall include commercial hot plates and griddles, food and dish warmers, coffee brewers and urns, waffle bakers, hot water immersion sterilizers, and other heat producing appliances designed for counter installation in hotels and restaurants.

7.2. Floor mounted type—mounting.

(a) Floor mounted restaurant type cooking appliances, except as provided in paragraphs (b), (d), (e), (f) and (g) of this section 7.2, 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, and where solid fuel is used, such construction shall extend not less than 18 inches at the front or side where ashes are removed.

(b) Floor mounted restaurant type cooking appliances that are approved specifically for installation on a floor constructed of combustible material may be mounted in accordance with the conditions of such approval.

(c) Gas burning floor mounted restaurant type cooking appliances that are designed and marked "For use only in fire-resistive locations" shall be mounted only in accordance with paragraph 7.2(a).

(d) Floor mounted restaurant type cooking appliances which are set on legs that provide not less than 18 inches open space under the base of the appliance, or which have no burners and no portion of any oven or broiler within 18 inches of the floor, may be mounted on floors other than as specified in paragraph 7.2(a), provided there is at least one sheet metal baffle between the burners and the floor.

(e) Floor mounted restaurant type cooking appliances which are set on legs that provide not less than 8 inches open space under the base of the appliance may be mounted on floors other than as specified in paragraph 7.2(a), provided the floor under the appliance is protected with asbestos millboard not less than ⅜ of an inch thick covered with sheet metal of not less than 24 gauge. The above specified floor protection shall extend not less than 6 inches beyond the appliance on all sides, and where solid fuel is used, such protection shall extend not less than 18 inches at the front or side where ashes are removed.

(f) Floor mounted restaurant type cooking appliances 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 7.2(a), provided the floor under the appliance is protected with hollow masonry not less than 4 inches thick covered with sheet metal of not less than 24 gauge. Such masonry shall be laid with ends unsealed and joints matched in such a way as to provide a free circulation of air through the masonry. Where solid fuel is used, the floor for 18 inches beyond the front of the appliance or side where ashes are removed shall be protected with asbestos millboard not less than ¼ of an inch

thick covered with sheet metal of not less than 24 gauge, or with protection equivalent thereto.

(g) Floor mounted restaurant type cooking appliances may be mounted on floors other than as specified in paragraph 7.2(a), provided the floor under the appliance is protected by two courses of 4-inch hollow masonry with courses laid at right angles and with ends unsealed and joints matched in such a way as to provide a free circulation of air through each masonry course. Such masonry shall be covered with a steel plate not less than 3/16 of an inch thick. Where solid fuel is used, the floor for 18 inches beyond the front of the appliance or side where ashes are removed shall be protected with asbestos millboard not less than ¼ of an inch thick covered with sheet metal of not less than 24 gauge, or with protection equivalent thereto.

7.3. Floor mounted type—clearances.

(a) Floor mounted restaurant type cooking appliances, except as provided in paragraphs (b), (d) and (e) of this section 7.3, shall be installed to provide a clearance to woodwork or other combustible material of not less than 18 inches at the sides and rear of the appliance and from the flue pipe or vent connector thereof, and not less than 48 inches above the cooking top and at the front of the appliance.

(b) Floor mounted restaurant type cooking appliances that are approved specifically for installation with lesser clearances than specified in paragraph 7.3(a) may be installed in accordance with the conditions of such approval.

(c) Gas burning, floor mounted restaurant type cooking appliances that are designed and marked "For use only in fire-resistive locations" shall not be installed elsewhere.

(d) Floor mounted restaurant type cooking appliances may be installed in rooms, but not in confined spaces such as alcoves or closets, with reduced clearances to woodwork or other combustible material, provided the combustible material or the appliance is protected as described in Table 2.3(b).

(e) Gas burning floor mounted restaurant type cooking appliances may be installed in rooms, but not in confined spaces such as alcoves, with reduced clearance of 6 inches to woodwork or other combustible material, provided the wall or combustible material is protected by sheet metal of not less than 26 gauge, 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.

(f) Any portion of a wall or fixture that is constructed of combustible material and is adjacent to the cooking top section of a floor mounted restaurant type cooking appliance shall be protected as described in paragraph 7.3(e) for a distance of at least 2 feet above the surface of the cooking top, unless such portion of the wall or fixture is shielded from the cooking top section by a high shelf or warming closet. Such wall or fixture shall be protected even though the appliance is certified for "close-to-wall" installation.

7.4. Counter type gas burning appliances—mounting.

(a) Counter type appliances, except as provided in paragraph 7.4(b), 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 of an inch thick covered with sheet metal of not less than 28 gauge, or with equivalent protection.

(b) Counter type appliances that are approved specifically for mounting on combustible material shall be set on their own legs or bases and may be mounted in accordance with the conditions of such approval.

7.5. Counter type gas burning appliances—clearances.

(a) Counter type commercial hot plates and griddles, except as provided in paragraph 7.5(d) and (e), shall be installed to provide a horizontal clearance of not less than 18 inches to woodwork or other combustible material.

(b) Counter type food and dish warmers, except as provided in paragraphs 7.5(d) and (e), shall be installed to provide a horizontal clearance of not less than 6 inches to woodwork or other combustible material.

(c) Counter type appliances other than those mentioned in paragraphs 7.5(a) and (b), except as provided in paragraphs 7.5(d), and (e), shall be installed to provide a horizontal clearance of not less than 12 inches to woodwork or other combustible material.

(d) Counter type appliances that are approved specifically for such installations may be installed with a minimum horizontal clearance of not less than 6 inches to woodwork or other combustible material.

(e) Counter type appliances may be installed with reduced clearances to woodwork or other combustible material provided the combustible material is protected as described in Table 2.3(b).

(f) Counter type commercial hot plates and griddles shall be installed to provide a vertical clearance of not less than 48 inches above the top to woodwork or other combustible material.

7.6 Portable baking and roasting ovens—mounting and clearances.

(a) Portable baking and roasting ovens shall be mounted in accordance with the requirements for domestic type heating and cooking appliances in section 3.2.

(b) Portable baking and roasting ovens shall be installed to provide clearances to woodwork or other combustible material in accordance with section 7.3.

7.7. Gas appliance vents.

Vents of gas burning appliances installed under a hood conforming to section 10 may discharge into the space under the hood. Such vents shall terminate 18 inches from any grease filter or screen installed in the hood.

SECTION 8. INDUSTRIAL FURNACES AND POWER BOILERS, STATIONARY TYPE.

8.1. Classification.

Stationary type industrial furnaces and power boilers shall be classified as low, medium or high heat appliances in accordance with their character and size and the temperatures developed in the portions thereof where substances or materials are heated for baking, drying, roasting, melting, vaporizing or other purpose. Where a furnace is not specifically classified in this section or there is any uncertainty as to its classification, it shall be placed in the class that most nearly resembles it with respect to character and size and the temperatures developed in the portions thereof where substances or materials are heated.

(a) **Low heat appliances** shall include furnaces developing temperatures up to 600 F. in the portions where substances or materials are heated, steam boilers operating at not over 50 pounds per square inch gauge pressure, and steam boilers of not over 10 boiler horsepower regardless of operating pressure. Appliances otherwise classed as medium heat appliances may be considered as low heat appliances if not larger than 100 cubic feet in size.

(b) **Medium heat appliances** shall include furnaces developing temperatures between 600 F. and 1500 F. in the portions where substances or materials are heated, and steam boilers of over 10 boiler horsepower operating at over 50 pounds per square inch gauge pressure. Appliances otherwise classed as high heat appliances may be considered as medium heat appliances if not larger than 100 cubic feet in size.

(c) **High heat appliances** shall include furnaces developing temperatures above 1500 F. in the portions where substances or materials are heated.

(d) Following are lists of industrial furnaces classified as low, medium and high heat appliances.

Low	Medium	High
1. Annealing Baths for hard glass (fats, paraffine, sales, or metals).	1. Alabaster Gypsum Kilns.	1. Bessemer Retorts.
2. Bake Ovens (in bakeries).	2. Annealing Furnaces (glass or metal).	2. Billet and Bloom Furnaces.
3. Boiling Vats, for wood fibre, straw, lignin, etc.	3. Charcoal Furnaces.	3. Blast Furnaces.
4. Candy Furnaces.	4. Cold Stirring Furnaces.	4. Bone Calcining Furnaces.
5. Coffee Roasting Ovens.	5. Feed Driers (direct fire heated).	5. Brass Furnaces.
6. Core Ovens.	6. Fertilizer Driers (direct fire heated).	6. Carbon Point Furnaces.
7. Cruller Furnaces.	7. Galvanizing Furnaces.	7. Cement Brick and Tile Kilns.
8. Feed Drying Ovens.	8. Gas Producers.	8. Coal and Water Gas Retorts.
9. Fertilizer Drying Ovens.	9. Hardening Furnaces (cherry to pale red).	9. Cupolas.
10. Forge Furnaces (solid fuel).	10. Lehrs and Glory Holes.	10. Earthenware Kilns.
11. Gypsum Kilns.	11. Lime Kilns.	11. Gas Blow Furnaces.
12. Hardening Furnaces (below dark red).	12. Linseed Oil Burning Furnaces.	12. Glass Furnaces (smelting).
13. Hot Air Engine Furnaces.	13. Porcelain Biscuit Kilns.	13. Glass Kilns.
14. Ladle Drying Furnaces.	14. Pulp Drier (direct fire heated).	14. Open Hearth Furnaces.
15. Lead Melting Furnaces.	15. Steam Boilers of over 10 boiler horsepower and operating at over 50 lb. per sq. in. gauge pressure.	15. Ore Roasting Furnaces.
16. Nickel Plate (drying) Furnaces.	16. Water-glass Kiln.	16. Porcelain Baking and Glazing Kilns.
17. Paraffine Furnaces.	17. Wood-distilling Furnaces.	17. Pot-Arches.
18. Recuperative Furnaces (spent materials).	18. Wood-gas Retorts.	18. Puddling Furnaces.
19. Rendering Furnaces.		19. Regenerative Furnaces.
20. Rosin Melting Furnaces.		20. Reverberatory Furnaces.
21. Steam Boilers operating at not over 50 lb. per sq. in. gauge pressure; and Steam Boilers of not over 10 boiler horsepower, including Pressing Machine Boilers.		21. Stacks, Carbureter or Superheating Furnaces (in water gas works-.
22. Stereotype Furnaces.		22. Welding Furnaces.
23. Sulphur Furnaces.		23. Wood Carbonizing Furnaces.
24. Tripoli Kilns (clay, coke, and gypsum).		
25. Type Foundry Furnaces.		
26. Wood Drying Furnaces.		
27. Wood Impregnating Furnaces.		
28. Zinc Amalgamating Furnaces.		

8.2. Low heat appliances—mounting.

(a) Except as provided in paragraphs 8.2(b), (c), (d) and (e), low heat appliances 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 in all cases extend not less than 12 inches beyond the appliance on all sides, and where solid fuel is used shall extend not less than 18 inches at the front or side where ashes are removed.

(b) Low heat appliances which are approved specifically for installation on a floor constructed of combustible material may be mounted in accordance with the conditions of such approval.

(c) Low heat appliances which are set on legs that provide not less than 18 inches open space under the base of the appliance may be mounted on floors other than as specified in paragraph 8.2(a), provided there is at least one sheet metal baffle between any burners and the floor, and further provided the appliance is so arranged that flame or hot gases do not come in contact with

its base. Where solid fuel is used, the floor under the appliance and for 18 inches beyond the front of the appliance or side where ashes are removed shall be protected with asbestos millboard not less than ¼ of an inch thick covered with sheet metal of not less than 24 gauge, or with protection equivalent thereto.

(d) Low heat appliances 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 8.2(a), provided the appliance is so arranged that flame or hot gases do not come in contact with its base, and further provided the floor under the appliance is protected with hollow masonry not less than 4 inches thick covered with sheet metal of not less than 24 gauge. Such masonry 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. Where solid fuel is used, the floor for 18 inches beyond the front of the appliance or side where ashes are removed shall be protected with asbestos millboard not less than ¼ of an inch thick covered with sheet metal of not less than 24 gauge, or with protection equivalent thereto.

(e) Low heat appliances may be mounted on floors other than as specified in paragraph 8.2(a), provided the floor under the appliance is protected by two courses of 4-inch hollow masonry that are laid at right angles and with ends unsealed and joints matched in such a way as to provide a free circulation of air through such masonry courses. Such masonry shall be covered with a steel plate not less than 3/16 of an inch thick. Where solid fuel is used, the floor for 18 inches beyond the front of the appliance or side where ashes are removed shall be protected with asbestos millboard not less than ¼ of an inch thick covered with sheet metal of not less than 24 gauge, or with protection equivalent thereto.

8.3. Low heat appliances—clearances.

(a) Except as provided in paragraphs 8.3(b) and (c), low heat appliances shall be installed to provide a clearance to woodwork or other combustible material, of not less than 18 inches above and at the sides and rear and not less than 48 inches at the front of the appliance, and of not less than 18 inches from the flue pipe or vent connector thereof, provided that for a low heat appliance encased in brick, the clearance above and at the sides and rear may be 12 inches. A clearance of not less than 12 inches shall be provided from low heat appliances to walls or ceilings of noncombustible construction which have combustible material placed on the outer or upper sides thereof, or which due to occupancy may have combustible material so placed.

(b) Low heat appliances which are approved specifically for installation with lesser clearances than specified in paragraph

8.3(a), may be installed in accordance with the conditions of such approval.

(c) Low heat appliances and their flue pipes or vent connectors may be installed with reduced clearances to woodwork or other combustible material, provided the combustible material or the appliance is protected as described in Table 2.3(b).

8.4. Medium heat appliances.

(a) Except as provided in paragraph 8.4(b), medium heat appliances shall be mounted on the ground or 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 extend not less than 3 feet beyond the appliance on all sides, and where solid fuel is used, it shall extend not less than 8 feet at the front or side where ashes are removed.

(b) Medium heat appliances which are set on legs that provide not less than 24 inches open space under the base of the appliance may be mounted on floors other than as specified in paragraph 8.4(a), provided the floor under the appliance is protected with hollow masonry not less than 4 inches thick covered with sheet metal of not less than 24 gauge.

(c) Medium heat appliances shall be installed to provide a clearance to woodwork or other combustible material of not less than 36 inches at the sides and rear, and not less than 48 inches above, and not less than 8 feet at the front of the appliance, and not less than 36 inches from the flue pipe or vent connector thereof, provided that for a medium heat appliance encased in brick the clearance above may be 36 inches and at the sides and rear it may be 18 inches. A clearance of not less than 24 inches shall be provided from medium heat appliances to walls or ceilings of noncombustible construction which have combustible material or construction placed on the outer or upper sides thereof, or which due to occupancy may have combustible material so placed.

(d) Rooms containing medium heat appliances shall be provided with means of ventilation adequate to prevent accumulation of hot air over the appliance.

8.5. High heat appliances.

(a) High heat appliances shall be mounted on the ground, or on floors of fire-resistive construction with noncombustible flooring or surface finish and with no combustible material or construction against the underside thereof. Such floors shall extend not less than 10 feet beyond the appliance on all sides and not less than 30 feet at the front or side where hot products are removed.

(b) High heat appliances shall be installed to provide a clearance to woodwork or other combustible material, of not less than 10 feet at the sides and rear, and not less than 15 feet above, and not less than 30 feet at the front or side where hot products are removed.

(c) Rooms containing high heat appliances shall be provided with means of ventilation adequate to prevent accumulation of hot air over or near the appliance.

SECTION 9. APPLIANCE CONNECTIONS TO CHIMNEYS OR VENTS.

9.1. Appliances required to be flue connected or vented.

(a) Every heat producing appliance burning solid or liquid fuel shall be connected to a chimney that is suitable and safe for such use, and every gas burning appliance shall be connected to a chimney or gas vent that is suitable and safe for such use, except that appliances covered by paragraphs (b), (c), (d) and (f) of this section 9.1, may be installed without connection to a chimney or vent. Chimneys and gas vents constructed and used in accordance with Article X of the National Building Code recommended by the National Board of Fire Underwriters shall be considered as suitable and safe for use as prescribed therein.

(b) Kerosene heaters and stoves that are approved specifically for use without a flue connection, may be installed in accordance with the conditions of such approval, except such heaters and stoves shall not be installed in sleeping quarters and in institutional occupancies. See paragraph 3.4.

(c) Gas burning ranges, hot plates, laundry stoves and domestic clothes dryers that are approved specifically for use without a vent, may be installed in accordance with the conditions of such approval.

(d) Gas burning water heaters with inputs not over 5,000 Btu per hour, gas refrigerators, counter appliances, room heaters except when installed in sleeping quarters and in institutional occupancies, and other gas burning appliances not provided with flue collars that are approved specifically for unvented use may be installed in accordance with conditions of such approval, except as provided by paragraph 9.1(e).

(e) When any or all of the appliances listed in paragraph 9.1(d) 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, they shall be flue or vent connected or provided with approved means for exhausting the flue gases to the outside atmosphere. Where 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.

(f) Industrial appliances which are designed for use without a connection to a chimney or vent and which do not create a health or fire hazard may be installed without such connection when the installation is in accordance with accepted engineering practices.

9.2. Flue pipes and vent connectors.

(a) Materials. Flue pipes and vent connectors shall be made of noncombustible material capable of withstanding the flue gas temperatures of the appliances and of sufficient thickness to withstand physical damage. The material of vent connectors shall also be resistant to corrosion.

(b) **Support.** Flue pipes and vent connectors shall be securely supported.

(c) **Pitch.** Flue pipes and vent connectors shall maintain a pitch or rise of at least ¼ inch to the foot (horizontal length) from the appliance to the chimney or vent.

(d) Size. The flue pipe or vent connector shall not be smaller than: (1) the size of the flue collar of the appliance, (2) the size recommended by the appliance manufacturer, or (3) the size of the outlet of the draft hood that is supplied by the manufacturer of the gas burning appliance.

(e) Passage through floors or ceilings. No flue pipe or vent connector shall pass through any floor or ceiling.

(f) Passage through walls. No flue pipe or vent connectors of any medium or high heat appliance as classified in section 8, shall pass through any wall or partition constructed of combustible material.

(g) Flue pipes of liquid or solid fuel burning appliances other than those for medium or high heat appliances as classified by section 8, shall not pass through walls or partitions constructed of combustible material unless they are guarded at the point of passage by:

(1) metal ventilated thimbles not less than 12 inches larger in diameter than the flue pipe or vent connector; or

(2) metal or burned fire clay thimbles built in brickwork or other approved fireproofing materials extending not less than 8 inches beyond all sides of the thimble; or

(3) in lieu of such protection all combustible material in the wall or partition shall be cut away from the flue pipe or vent connector a sufficient distance to provide the clearance required from such flue pipe or vent connector. Any material used to close up such opening shall be noncombustible.

(h) Vent connectors for gas burning appliances other than those of type B and those for medium and high heat appliances as classified by section 8, shall not pass through walls or parti-

tions constructed of combustible material unless they are guarded at the point of passage by ventilated metal thimbles not smaller than the following:

(1) For gas burning appliances, except floor furnaces and incinerators, that have been tested by an approved agency and found to have flue gas temperatures not exceeding 550 F.—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 than the vent connector;

(2) For gas burning floor furnaces and for all gas burning appliances, except incinerators, that have not been tested by an approved testing agency—6 inches larger in diameter than the vent connector;

(3) For incinerators—12 inches larger in diameter than the vent connector.

(i) Clearances. For flue pipe and vent connector clearances see the sections dealing with clearances for individual types of appliances.

9.3. Interconnection of flue pipes and vent connectors.

No flue or vent connector from a gas burning appliance shall be connected to a flue which serves appliances burning either liquid or solid fuel, unless such appliance is equipped with an automatic pilot. The automatic pilot shall automatically shut off the gas supply to the burner or burners being served when the pilot is extinguished. For liquefied petroleum gases, the automatic pilot shall automatically shut off the gas supply to the pilot as well as to the main burners.

9.4. Dampers.

(a) Manually operated dampers shall not be placed in flue pipes or vent connectors of liquid or gas burning appliances except as given in paragraph 9.4(b). Fixed baffles on the appliance side of draft hoods and draft regulators shall not be classified as dampers.

(b) A manually operated or barometric damper may be installed in the flue pipe of a gas incinerator when recommended by the manufacturer. Such manual damper shall be so constructed that it will not close off more than 80 per cent of the cross-sectional area of the flue pipe.

9.5. Draft regulators.

(a) A draft regulator shall be provided in the flue pipe of each liquid fuel burning appliance unless the burner is approved for use without one.

(b) A draft regulator when used shall be installed in the same room or enclosure as the appliance and in such a manner that no difference in pressure between the air in the vicinity of the regulator and the combustion air supply will be permitted.

9.6. Draft hoods.

(a) A draft hood shall be provided for each vented gas burning appliance except incinerators, dual oven type combination ranges, units designed for power burners or forced venting and industrial appliances which require positive draft. If the draft hood is not a part of the appliance or supplied by the manufacturer, it shall be the same size as the appliance flue collar unless the manufacturer's instructions state otherwise.

(b) Where the draft hood is a part of the appliance or is supplied by the appliance manufacturer it shall be installed without alteration and 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.

9.7. Flue exhausters.

Flue exhausters may be used with gas burning appliances in lieu of natural draft vents except on incinerators. Where a flue exhauster is used with gas burning appliances requiring venting, provisions shall be made to prevent the flow of gas to the main burners in the event of failure of the exhaust system.

SECTION 10. VENTILATING HOODS.

10.1. Required locations.

Commercial cooking appliances such as restaurant type ranges, deep fat fryers, broilers, and roasting ovens, candy kettles, cruller furnaces, and commercial and industrial appliances that present a fire hazard similar to commercial frying operations shall be provided with ventilating hoods and exhaust ducts; unless such appliances are enclosed and vented in an approved manner.

10.2. Materials and installation.

(a) Hoods shall be constructed of approved noncombustible materials with tight joints.

SECTION 11. STEAM AND HOT WATER PIPES.

11.1. Clearances.

(a) Steam pipes and hot water pipes shall be installed with a clearance of at least one inch to all combustible material except as specified in paragraphs (b) and (c) of this section 11.1.

(b) At points where pipes carrying steam or hot water at not over 15 pounds per square inch gauge pressure emerge from a floor, wall or ceiling, the clearance at the opening through the finish floor boards or wall or ceiling boards may be less than one inch but shall not be less than ½ of an inch. Each such opening shall be covered with a plate of noncombustible material.

(c) Hot water pipes on a system with automatic firing and with limit controls such that water temperature at the boiler or furnace cannot rise above 150 F. may be installed with no clearance to combustible material.

11.2. Protection.

(a) Steam pipes and hot water pipes passing through stock shelving shall be covered with approved insulation not less than 1 inch thick.

(b) Wooden boxes or casings enclosing steam or hot water heating pipes, or wooden covers to recesses in walls in which such pipes are placed shall be lined with sheet metal of not less than 28 gauge or asbestos millboard not less than ¼ of an inch thick.

(c) Coverings or insulation used on steam or hot water pipes shall be of noncombustible material.

(d) Where steam pipes and hot water pipes pass through a floor, wall or ceiling of fire-resistive construction, the openings around them shall be filled with noncombustible material to prevent the passage of fire.

11.3. Antifreeze solutions for radiant heating coils.

Antifreeze solutions used in radiant heating coils shall not contain any liquid with a flash point less than 225 F.

SECTION 12. RESIDENCE TYPE WARM AIR HEATING AND AIR CONDITIONING SYSTEMS.

12.1. Application.

This section applies to residence type central warm air heating systems including combination heating and air conditioning systems. This section does not apply to other air conditioners in which no heating is incorporated, or to heat pumps.

12.2. Definitions.

(a) **Central warm air heating system** means a heating system consisting of a heat exchanger with an outer casing or jacket, or an electric heating unit, connected to a supply system and a return system.

(b) **Forced air system** means a central warm air heating system that is equipped with a fan or blower which provides the primary means for circulation of air.

(c) **Gravity system** means a central warm air heating system through which air is circulated by gravity. It may also use an integral fan or blower that is used only to overcome the internal furnace resistance to air flow.

(d) **Heat exchanger** means a chamber in which heat resulting directly from combustion of fuel or heat from a medium such as air, water or steam is transferred through the walls of the chamber to the air entering the supply system.

(e) **Plenum** means an air compartment or chamber to which one or more ducts are connected and which forms part of either the supply or return system.

(f) **Return system** means an assembly of connected ducts, air passages or plenums and fittings through which air from the space or spaces to be heated is conducted back to the heat exchanger.

(g) **Supply system** means an assembly of connected ducts, air passages or plenums and fittings through which air, heated in a heat exchanger, is conducted from the heat exchanger to the space or spaces to be heated.

12.3. Supply ducts—construction.

(a) Duct material. Except as permitted by paragraphs 12.3(a) (3) and (4), supply ducts shall be constructed entirely of noncombustible material equivalent in structural strength and durability to the following:

(1) Ducts Not Enclosed in Partitions:

Round Ducts

Diameter, Inches	Minimum Thickness Galv. Iron U. S. Gauge	Minimum Thickness Aluminum B & S Gauge	Minimum Weight of Tin Plate
Less than 12	30	26	IC (107 lb.)
12 or more	28	26	IX (135 lb.)

Rectangular Ducts

Width, Inches	Minimum Thickness Galv. Iron U. S. Gauge	Minimum Thickness Aluminum B & S Gauge
Less than 14	28	26
14 or more	26	24

(2) Ducts Enclosed in Partitions:

Rectangular Ducts

Width, Inches	Minimum Thickness Galv. Iron U. S. Gauge	Minimum Thickness Aluminum B & S Gauge	Minimum Weight of Tin Plate
14 or less	30	26	IC (107 lb.)
Over 14	28	26	IX (135 lb.)

(3) Supply ducts that are completely encased in not less than 2 inches of concrete in a floor slab need not be constructed of noncombustible material except those portions that are within 2 feet of the vertical supply plenum and within 2 feet of a connection to a vertical riser or register.

(4) Vibration isolation connectors in duct systems shall be made of woven asbestos or approved flameproofed fabric or shall consist of sleeve joints with packing of rope asbestos or other approved noncombustible material. Vibration isolation connectors of flameproofed fabric shall not exceed 10 inches in length.

(b) Duct joints. Joints and seams of supply ducts shall be securely fastened and made substantially air tight. Slip joints shall have a lap of at least one inch and shall be individually fastened. Tape used for sealing joints shall be not more combustible than approved flameproofed fabric.

(c) Duct hangers. Supply ducts shall be securely supported by metal hangers, straps, lugs or brackets. No nails shall be driven through the duct walls and no unnecessary holes shall be cut therein.

(d) Firestopping. Where the installation of supply ducts in walls, floors, or partitions requires the removal of any firestopping, the spaces around the duct at such points where firestopping was removed shall be sealed with asbestos, mineral wool, or other noncombustible insulating material.

(e) Covering of exposed vertical supply ducts. Where vertical supply ducts are exposed in closets or rooms, the ducts shall be covered with approved air cell asbestos not less than ¼ of an inch thick or other equivalent fire-resistant insulation.

(f) Registers for ducts. Warm air furnace systems, other than systems which are automatically fired with liquid or gas fuel, or electricity and have approved temperature limit controls, shall have at least one register or grille without a closeable shutter and the duct leading thereto shall be without a damper, except where dampers and shutters cannot shut off more than 80 per cent of the duct area.

12.4. Clearances from horizontal supply ducts.

(a) Where ducts are adjacent to plaster on metal lath or to other noncombustible material attached to a combustible material, the clearance shall be measured to the combustible material, excpet that the clearance shall be measured to the surface of the plaster or other noncombustible finish where a clearance of 1 inch or 2 inches is specified above supply ducts within the distance from the plenum specified in paragraphs 12.4(b) (1) and (2). This shall not be construed to prohibit closure of openings with noncombustible material where ducts pass through walls and partitions, as provided in paragraph 12.4(b) (6).

(b) Minimum clearances from horizontal supply ducts shall be as follows:

(1) Within a distance of 3 feet of the plenum of a system classified under Items I and III of Table 2.3(a), the clearance shall be not less than specified above the bonnet or plenum.

(2) Within a distance of 6 feet of the plenum of a system classified under Items II, IV and VI of Table 2.3(a), the clearance shall be not less than specified above the bonnet or plenum.

(3) Beyond the distance from the plenum specified in paragraphs 12.4(b) (1) and (2), no clearance is required except as provided in paragraphs 12.4(b) (4) and (5).

(4) From ducts of furnaces classfied under Item IV of Table 2.3(a), the clearance shall be not less than 6 inches out to 6 feet and one inch beyond 6 feet to a point where there is a change in direction equivalent to 90 degrees or more.

(5) From ducts of furnaces that require 18-inch clearance above the bonnet or plenum (see Table 2.3(a)), the clearance shall be not less than 18 inches out to 3 feet, not less than 6 inches from 3 feet to 6 feet, and not less than one inch beyond 6 feet.

(6) Where a horizontal supply duct passes through or pierces a partition or enclosure constructed of combustible material, the clearance shall be not less than specified in paragraphs 12.4(b) (1), (2), (4) and (5). The ends of the space providing this clearance may be closed with a thimble and collar, or the wall surfaces extended to the duct with noncombustible building material such as plaster on metal lath.

12.5. Clearances from vertical ducts, risers, boots and register boxes.

(a) Where a duct, riser, boot or box on a system that does not require 18-inch clearance above the supply plenum or bonnet enters a floor, partition or enclosure constructed of combustible material within the distance from the plenum specified in paragraphs 12.4(b) (1) and (2), the clearance from such duct, riser or boot shall be not less than the distance required above the furnace bonnet or plenum (see Table 2.3(a)), or the duct shall change direction equivalent to at least two 90 degree turns before entering such floor, partition, or enclosure. The above does not apply to pipeless furnaces covered in paragraph 12.6.

(b) Where a supply duct enters the floor of the first story above that in which the furnace is located, the space around the duct at such points shall be sealed with asbestos cement or other noncombustible material.

(c) Where a duct, riser, boot or box on a system that requires 18-inch clearance above the supply plenum or bonnet enters a floor, partition, or enclosure constructed of combustible material

within a horizontal distance of 6 feet of the furnace, the duct shall be so arranged that heated air must travel at least 6 feet from the closest primary heating surface and change direction equivalent to at least one 90 degree turn before entering such floor, partition or enclosure.

(d) Where a duct, riser, boot or box on a system that requires 18-inch clearance above the supply plenum or bonnet enters the floor of the first story above that in which the furnace is situated, the clearance shall be at least 3/16 of an inch from all combustible material in the floor consrtuction, unless the duct is of double wall construction with a continuous air space of not less than 3/16 of an inch between the inner and outer walls.

(e) Where a duct or riser on a system that requires 18-inch clearance above the supply plenum or bonnet is enclosed in a partition, wall, or concealed space constructed of combustible material:

(1) Such duct shall be installed with an air space of not less than 3/16 of an inch between the duct and the combustible material, unless a noncombustible insulating covering of cellular type at least ⅛ inch thick is provided (in metal lath and plaster partitions no air space is needed except from wood studs);

(2) Or, such duct shall be made double with a continuous air space of not less than 3/16 of an inch between the inner and outer walls.

(f) Where a register on a system that requires 18-inch clearance above the supply plenum or bonnet is placed in a floor or wall constructed of combustible material, the register box shall be installed with a clear space of not less than 3/16 inch between the top and sides of the box and any combustible material.

12.6. Pipeless furnace registers.

Where registers are installed in the floor over the furnace (as in the "pipeless" furnace), the register box shall be constructed double with an air space not less than 4 inches between, except where the warm air passage is surrounded by a cold air passage.

12.7. Heating panels.

Air chambers, having one or more external surfaces designed for use as heating panels shall comply with the following:

(a) Use. Heating panels shall be used only with:

(1) Automatically fired gas or oil burning forced warm air systems equipped with temperature limit controls that cannot be set above 200 F.;

(2) Or, forced warm air systems equipped with heat exchangers utilizing steam which cannot exceed 15 pounds gauge pressure or hot water which cannot exceed a temperature of 250 F.

(b) Connection. Heating panels shall be connected to supply ducts conforming to section 12.3 and return air ducts conforming to section 12.8.

(c) Construction.

(1) Where warm air supply is from a warm air furnace, heating panels shall be enclosed on all sides with material which is wholly noncombustible or which possesses a flame spread rating of not over 20 as determined in accordance with the Method for Fire Hazard Classification of Building Materials, ASTM E84, Underwriters Laboratories, Inc., Standard. This enclosing material shall be securely attached to the building structure; joints and seams shall be substantially air tight. Braces and hangers inside the chamber shall be noncombustible.

(2) Where warm air supply is from a steam or hot water heat exchanger, heating panels shall either comply with paragraph 12.7(c)(1), or shall be enclosed on all sides with material not more flammable than 1-inch wood boards. This enclosing material shall be securely attached to the building structure; joints and seams shall be substantially air tight. No single vertical heating panel shall serve more than one story.

12.8. Return ducts.

(a) Duct material.

(1) Return ducts, except as required by paragraph 12.8(a)(2), may be constructed of metal, of one-inch (nominal) wood boards, or other suitable material, provided that no material more flammable than one-inch boards shall be used.

(2) Portions of return ducts directly above the heating surface, or closer than 2 feet from the outer jacket or casing of the heater shall be constructed in accordance with provisions of paragraph 12.3 for supply ducts.

(3) The interior of combustible ducts shall be lined with noncombustible material at points where there might be danger from incandescent particles dropped through the register or heater, such as directly under floor registers and the bottom of vertical ducts or directly under heaters having a bottom return.

(b) Firestopping.

(1) Where return ducts are installed in walls, floors or partitions, their installation shall comply with the provisions of paragraph 12.3(d).

(2) Where spaces between studs in walls or partitions are used as ducts, the portions of such spaces so used shall be cut off from all remaining unused portions by tight fitting stops of sheet metal or of wood not less than 2 inches (nominal) thick.

(c) Duct openings. No vertical duct shall have openings to receive return air on more than one floor.

(d) Continuous ducts.

(1) Return air shall be conducted to the heater through continuous ducts, except as indicated in paragraphs 12.8(d) (2) and (3).

(2) Underfloor spaces may be used as ducts for return of air from rooms directly above, provided such spaces are not over 2 feet in height to bottom of floor joists and are cleaned of all combustible material and are tighly and substantially enclosed.

(3) In a single story residence, the return air may travel through the first floor living space to furnace air inlet grilles located at or above the first floor level.

(e) Public hall as plenum. Public halls or public stairways shall not be used as plenums.

(f) Negative pressure from circulating fan. The return system shall be arranged so that negative pressure from the circulating fan cannot affect the air supply for combustion or act to draw products of combustion from joints or openings in the furnace or flue.

12.9. Air cooling equipment.

(a) Installation. Mechanical refrigeration used with air duct systems shall be installed in accordance with nationally recognized safe practices. Installations conforming to the American Standard Safety Code for Mechanical Refrigeration, ASA-B9.1, shall be considered as meeting these requirements.

(b) Cooling and heating units in series or parallel.

(1) Heating furnaces of the combustion type shall not be located downstream from cooling units unless the furnace is approved for such use.

(2) Heating 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.

(3) Heating furnaces may be installed in parallel with cooling units by use of dampers located to direct the air to either the furnace only, or to the cooling unit only, as desired.

SECTION 13. AIR CONDITIONING, WARM AIR HEATING, AIR COOLING AND VENTILATING SYSTEMS, OF OTHER THAN RESIDENCE TYPE.

13.1. Application.

This section applies to air duct systems employing mechanical means for the movement of air and used for heating and ventilating, including air conditioning systems, combination heating

and ventilating systems, exhaust systems, plain ventilating systems, and warm air heating systems, except that it does not apply to residence type systems nor to systems for removal of flammable vapors and residues nor to systems for conveying dust, stock or refuse by means of air currents.

13.2. Construction of ducts.

(a) Ducts shall be constructed entirely of noncombustible material, such as iron, steel, aluminum or other approved material.

(b) Ducts shall be so constructed as to provide structural strength and durability at least the equivalent of materials of the thicknesses specified in the table below, except that spirally wound ducts, under 6 inches in diameter may be of 30 U. S. gauge steel. Wired glass may be used for inspection windows in ducts.

Thickness of Metal for Air Ducts.

Round Ducts Diameter (Inches)	Rectangular Ducts Max. Side (Inches)	Minimum Thickness of Steel U. S. Gauge	Minimum Thickness of Aluminum B & S Gauge
Up to 13	Up to 12	26	24
14 to 33½	13 to 30	24	22
34 to 67½	31 to 60	22	20
	61 to 90	20	18
	91 and above	18	16

(c) Ducts may be of independent construction or may be formed by parts of the building structure, provided that they conform to the requirements of this section. Construction consisting of not less than ¾-inch cement or gypsum plaster on metal lath applied to either combustible or noncombustible supports may be used as duct walls.

(d) Flexible duct connectors for use between ducts and air outlets or air outlet units need not conform to the requirements for ducts if they conform to the following provisions and are approved for this use:

(1) They shall be made from a base material of metal or mineral.

(2) They shall not be subject to deterioration from mildew or moisture.

(3) They shall not be more combustible than approved flameproofed fabric.

(4) They shall not exceed 12 feet in length.

(5) They shall not exceed 8 inches in diameter.

(6) They shall not pass through any fire wall, required two-hour partition, or floor.

(7) They shall be covered with not less than one-half inch of noncombustible insulating material or shall be located in an enclosure constructed of noncombustible material.

(e) Vibration isolation connectors in duct systems, other than as covered by paragraph 13.2(f), shall be made of woven asbestos or approval flameproofed fabric or shall consist of sleeve joints with packing of rope asbestos or other approved noncombustible material. Vibration isolation connectors of fabric shall not exceed 10 inches in length.

(f) A vibration isolation connector at the joint between duct and fan where the inlets to the fan, if of exhaust type, or the outlets from the fan are in the same room or enclosure as the joint shall be exempt from paragraph 13.2(e) if not over 10 inches in length.

(g) Only approved fire-resistive linings shall be used inside of ducts.

(h) Combustible coverings shall not be used on the outside of ducts carrying air at a temperature above 175 F.

(i) Work involving the use of torches shall not be undertaken on ducts until the system has been shut down, the duct cleaned and all combustible lining and covering material has been removed from the portion of the duct being altered.

(j) Ducts shall be made reasonably tight throughout and shall have no openings other than those required for the proper operation and maintenance of the system.

(k) Tape used for sealing joints shall be not more combustible than approved flameproofed fabric.

13.3. Cleanout openings in ducts.

(a) Return ducts, other than vertical, shall be so constructed that the interior is accessible for cleaning, except that accessibility is not required where all of the following conditions prevail:

(1) The occupancy is not productive of combustible material, such as lint, dust or greasy vapors. Such occupancies are banks, offices, churches, hotels and institutions (but not kitchens, service rooms and manufacturing portions).

(2) The return openings are at least 7 feet above the floor or are protected by corrosion-resistant metal screens of at least 14 mesh installed back of the grilles so that they will not draw in papers, refuse, cigarettes and other combustible solids.

(3) The minimum design velocity in the return from the particular occupancy is 1,000 feet per minute.

(b) Cleanout openings at approximately 20-feet intervals shall be provided where accessibility to facilitate cleaning is required and where the ducts are smaller than 18 x 24-inch. Removable grilles of adequate size and accessibility may be accepted as cleanout openings.

(c) Supply ducts, other than vertical, shall conform to the above regulation for return ducts, unless all of the supply air passes through either water spray or filters.

13.4. Installation of ducts.

(a) Ducts shall not be built into a building in such a way as to impair the effectiveness of the fireproofing around steel or iron structural members, such as placing ducts between the fireproofing and the members protected, except in the case of beams or joists protected by a fire-resisting ceiling.

(b) Where the installation of ducts in walls, floors, or partitions requires the removal of any firestopping, the spaces around the duct at such points where firestopping was removed shall be tightly filled with asbestos, mineral wool or other noncombustible material.

(c) Ducts which pass through floors of fire-resistive construction, protected noncombustible construction, or heavy timber construction, and in which vertical openings are protected shall be encased in 4-inch hollow clay tile, 4-inch gypsum block, or their equivalent except as qualified below:

(1) The encasing of ducts shall not be required for branches which are cut off from the main portion of the duct by approved fire dampers.

(2) Ducts which are located in one story and have all duct openings extending through a floor to the story next above or below may in lieu of such fire-resistive enclosure be provided with approved fire dampers at each such point where the floor is pierced.

(3) Two or more ducts serving separate floors shall not be encased in the same fire-resistive enclosure unless approved automatic fire dampers are installed where each branch is taken from such encased ducts.

(d) Public exit halls in institutional occupancies and in hotels and multifamily houses shall not be used as plenums, that is, as compartments to which one or more ducts are connected so as to form part of the air distribution system.

(e) Ducts shall be substantially supported. Hangers and brackets for supporting ducts shall be of metal.

13.5. Clearances from warm air ducts.

(a) Metal warm air ducts shall be installed with clearances to combustible material as follows:

(1) Within a distance of 3 feet of the plenum of a system classified under Item I and III of Table 2.3(a), the clearance shall be not less than specified above the bonnet or plenum.

(2) Within a distance of 6 feet of the plenum of a system classified under Items II, IV and VI of Table 2.3(a), the clearance shall be not less than specified above the bonnet or plenum.

(3) Beyond the distance from the plenum specified in paragraph 13.5(a) and (b), the clearance shall be not less than ½ inch except as provided in paragraphs 13.5(a)(4) and (5).

(4) From ducts of furnaces classified under Item IV of Table 2.3(a), the clearance shall be not less than 6 inches out to 6 feet and one inch beyond 6 feet to a point where there is a change in direction equivalent to 90 degrees or more.

(5) From ducts of furnaces that require 18-inch clearance above the bonnet or plenum (see Table 2.3(a)) the clearance shall be not less than 18 inches out to 3 feet, not less than 6 inches from 3 feet to 6 feet, and not less than one inch from 6 feet to 12 feet.

(b) Where a metal warm air duct passes through or pierces a partition or enclosure constructed of combustible material, the ends of the space providing the required clearance may be closed with a thimble and collar or the wall surfaces extended to the duct with noncombustible building materials such as plaster on metal lath.

13.6. Automatic fire doors and dampers.

(a) When ducts or the outlets from or inlets to them pass through fire walls, they shall be provided with approved automatic fire doors on both sides of the wall through which they pass. On small openings not exceeding 18 inches in diameter, ⅜-inch steel plates may be used as fire doors. Suitable hand hole openings shall be provided to make all fire doors and fire dampers in ducts accessible for inspection and servicing.

(b) An approved fire damper shall be provided on each opening through a required two-hour partition.

(c) In a system having a total fan capacity in excess of 3,000 cubic feet per minute, each main duct which serves more than one floor shall be provided with an approved fire damper at the floor or ceiling level of each floor served, or at each direct opening in such main duct and in each branch at its junction with the main duct.

(d) Aluminum ducts which pass through floors of fire-resistive construction, unless encased as specified in section 13.4(c), shall have approved fire dampers at the floors.

(e) Dampers in systems used solely for exhaust of air to the outside shall be installed in the branches so as not to interfere with the outward flow of air in the main duct. Where direction of exhaust air flow is upward, subducts at least 22 inches in length may be carried up inside the main duct from each inlet, in lieu of dampers.

13.7. Fresh air intakes.

(a) Fresh air intakes shall be protected against exterior fire exposure by approved fire doors, dampers or other suitable protection in accordance with the degree of exposure hazard.

(b) Fresh air intakes shall be protected by screens of corrosion resistant material not larger than one-half inch mesh.

13.8. Air inlet and outlet openings.

(a) In a system having a total fan capacity in excess of 3,000 cubic feet per minute, discharge and exhaust air openings and recirculating air intakes shall be located at least 3 inches above the floor, except that floor openings may be permitted under seats in places of assembly having fixed seats.

(b) When located less than 7 feet above the floor, inlet and outlet openings shall be protected by a substantial grille or screen that has openings through which a half-inch sphere will not pass.

13.9. Air filters.

(a) Air filters shall be of approved types that will not burn freely or emit large volume of smoke or other objectionable products of combustion when attacked by flames.

(b) Liquid adhesive coatings used on air filters shall have a flashpoint not lower than 325 F., Cleveland open cup tester.

13.10. Controls.

(a) Each installation shall be equipped with a manual emergency stop control, located at a conveniently accessible point, for quick shutting down of the fan in case of fire.

(b) In systems utilizing recirculation, serving more than one story of a building, or more than one fire section of a single story, fans shall be arranged to shut down automatically when the temperature of the air in the system becomes excessive, as from a fire. For this purpose an approved thermostatic device with a setting not in excess of 125 F. shall be located in the system at a suitable point in the return air duct ahead of the fresh air intake. Either the thermostatic device shall be of a type that is manually reset or the control system shall be so arranged that some manual operation is required to restart the fan after the thermostat has operated.

13.11. Air cooling equipment.

Mechancial refrigeration used with air duct systems shall be installed in accordance with nationally recognized safe practices. Installations conforming to the American Standard Safety Code for Mechancial Refrigeration, ASA-B9.1, shall be considered as meeting these requirements.

SECTION 14. DOMESTIC TYPE INCINERATORS.

14.1. Application.

This section applies to direct-fed incinerators having a firebox or charging compartment of not over 5 cubic feet in capacity when used in dwellings and in other occupancies where the character and amount of refuse burned is not excessive as compared to a dwelling.

14.2. Gas burner connections.

Where a gas burner is used, a shut-off cock shall be provided at an accessible location in the gas line to the burner. Incinerators for use with liquefied petroleum gas and those furnished with means for automatic ignition of the gas at the main burner shall be equipped with a device which will automatically shut off the main gas supply in the event the means of ignition becomes inoperative, or the means of keeping the valve of the device open becomes inoperative, or both. Where liquefied petroleum gas is used, the arrangement shall be such as to shut off the gas supply to the pilot burner also.

14.3. Mounting.

(a) Domestic type incinerators, execpt as provided in paragraphs 14.3(b) and (c), 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 that at the front or side where ashes are removed, it shall extend not less than 18 inches beyond the incinerator.

(b) Domestic type incinerators that are specifically approved for installation on a combustible floor may be mounted in accordance with the conditions of such approval.

(c) Domestic type incinerators which are set on legs that provide not less than 4 inches open space under the base of the incinerator may be mounted on floors other than as specified in paragraph 14.3(a), 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 thick covered with sheet metal of not less than 24 gauge. 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 asbestos millboard not less than ¼ of an inch thick covered with sheet

metal of not less than 24 gauge, or with protection equivalent thereto.

14.4. Clearances.

(a) Domestic type incinerators, except as provided in paragraphs 14.4(b) and (c), shall be installed to provide clearances between the unit and woodwork or other 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 the charging door be less than 48 inches.

(b) Domestic type incinerators that are specifically approved for installation with clearances less than specified in paragraph 14.4(a) may be installed in accordance with the conditions of such approval, provided that in any case, the clearances shall be sufficient to afford ready accessibility for firing, clean-out and any necessary servicing, and with a minimum clearance of 3 inches between the sides and combustible material.

(c) Domestic type incinerators may be installed in rooms, but not in confined spaces such as alcoves, with reduced clearances to woodwork or other combustible material, provided the combustible material is protected as described in Table 2.3(b), but in no case shall this clearance be less than 3 inches to the protection.

(d) 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 28 gauge sheet metal spaced out 1 inch, or equivalent protection.

14.5. Chimney.

Domestic type incinerators shall be connected to a chimney suitable for solid fuel burning appliances.

14.6. Flue pipes.

(a) Domestic type incinerator flue pipes, except as provided in paragraph 14.6(b), shall be installed to provide clearance of not less than 18 inches to woodwork or other combustible material.

(b) Domestic type incinerator flue pipes may be installed in rooms, but not in confined spaces such as alcoves, with reduced clearances to woodwork or other combustible material provided the combustible material is protected as described in Table 2.3(b).

(c) Domestic type incinerator flue pipes shall not pass through any combustible wall or partition unless protected at the point of passage in accordance with paragraph 9.2(g).

14.7. Refuse chutes.

Refuse chutes shall not feed directly into incinerators.

SECTION 15. FLUE-FED INCINERATORS. (APARTMENT HOUSE TYPE)

15.1. Application.

This section applies to incinerators having a combined refuse chute and smoke flue with provisions for feeding waste materials directly into the combustion chamber from one or more floors above the incinerator.

15.2. Provisions for auxiliary fuel.

Where a gas burner is used, a shut-off cock shall be provided at an accessible location in the gas line to the burner. Incinerators for use with liquefied petroleum gas, those having an input of more than 50,000 Btu per hour and those furnished with means for automatic ignition of the gas at the main burner shall be equipped with a device which will automatically shut off the main gas supply in the event the means of ignition becomes inoperative, or the means of keeping the valve of the device open becomes inoperative, or both. Where liquefied petroleum gas is used, the arrangement shall be such as to shut off the gas supply to the pilot burner also.

15.3. Combustion chambers.

(a) Enclosing walls of combustion chambers having a horizontal combined hearth and grate area of 7 square feet or less shall be constructed of clay or shale brickwork not less than 4 inches thick with a lining of fire brick not less than 4½ inches thick, or of construction equivalent thereto.

(b) Enclosing walls of combustion chambers having a horizontal combined hearth and grate area exceeding 7 square feet shall be constructed of clay or shale brickwood not less than 8 inches thick and 4½ inches of fire brick as a lining with a space between the clay or shale brickwork and the fire brick lining sufficient to provide for expansion and contraction, or of construction equivalent thereto.

(c) Fire brick shall be laid in high temperature cement or fire clay mortar. All common brickwork shall be laid with full, push filled, cross and bed mortar joints.

(d) No metal stays, lintels not part of a door frame casting, or other supports shall be exposed to the interior of the furnace or the products of combustion where auxiliary fuel is provided or where the incinerator is designed for operation at or above 1,000 F.

15.4. Combined refuse chute and flue.

The chimney of a flue-fed incinerator shall be constructed in accordance with nationally recognized good practice. Construction in accordance with Article X of the National Building Code

recommended by the National Board of Fire Underwriters shall be considered as in accordance with nationally recognized good practice.

15.5. Service openings to incinerators.

(a) The daylight area of each service opening shall be limited to one-third of the cross-sectional area of the flue, except that in one family dwellings, the service opening may be one-half the cross-sectional area of the flue. Where the flue area exceeds 22 by 22 inches, no service opening shall be used that has an area in excess of 160 square inches.

(b) All service openings into an incinerator flue shall be provided with a hopper or other charging device constructed of metal of sufficient thickness and durability to prevent cracking, breakage or deformation in normal use. Such hopper or other charging device shall be firmly built into the masonry and shall be so designed and installed that no part will project into the flue and that the opening to the flue interior will be closed off while the service opening (hopper) door is fully open. The hopper or other device shall be counterweighted or otherwise devised so that it will close automatically upon release and be so constructed as to be tightly fitted when in the closed position.

(c) No service opening shall be installed in any part of the combustion zone of an incinerator.

15.6. Mounting.

Flue-fed incinerators shall be set on proper foundations on the ground or on fire-resistive floors with no combustible material on the underside thereof.

15.7. Incinerator rooms.

(a) Incinerators in which the combined hearth and grate area of the combustion chamber exceeds 7 square feet shall be enclosed within a room separated from other parts of the building by walls, and floor and ceiling assemblies having a fire resistance rating of not less than 2 hours.

(b) Door or other openings in rooms containing incinerators communicating with other areas of the building shall be protected by approved self-closing or automatic fire doors suitable for Class B situations.

(c) Ducts extending from an incinerator room through other parts of a building shall be constructed and protected in accordance with section 13.

15.8. Spark arresters, expansion chambers.

All flues shall terminate in a substantially constructed spark arrester with openings not greater than ½ of an inch, or be provided with other suitable means for avoiding discharge of fly

particles. Expansion chambers used as a secondary combustion chamber shall be constructed equivalent to that of the incinerator combustion chamber, section 15.3. Expansion chambers that are used only for settling shall be of construction equivalent to that of the upper portion of incinerator flue, and a clearance of not less than 2 inches from the chamber to combustible construction shall be provided. Expansion chambers shall be provided with substantial noncombustible supports. Every expansion chamber shall have a vent of cross-sectional area at least equal to that of the flue.

SECTION 16. COMMERCIAL AND INDUSTRIAL TYPE INCINERATORS.

16.1. Application.

This section applies to incinerators other than outdoor waste or trash burners and those covered in sections 14 and 15.

16.2. Provisions for auxiliary fuel.

Where a gas burner is used, a shut-off cock shall be provided at an accessible location in the gas line to the burner. Incinerators for use with liquefied petroleum gas, those having an input of more than 50,000 Btu per hour and those furnished with means for automatic ignition of the gas at the main burner shall be equipped with a device which will automatically shut off the main gas supply in the event the means of ignition becomes inoperative, or the means of keeping the valve of the device open becomes inoperative, or both. Where liquefied petroleum gas is used the arrangement shall be such as to shut off the gas supply to the pilot burner also.

16.3. Combustion chambers.

(a) Incinerators shall have the enclosing walls of combustion chambers constructed of clay or shale brick not less than 8 inches thick with a lining of fire brick not less than 4½ inches thick, or of construction equivalent in structural strength, in insulating value and in ability to withstand thermal expansion and flame impingement. Provision shall be made for expansion and contraction of fire brick.

(b) Enclosing walls of incinerators shall be strongly braced and stayed with structural steel shapes designed to withstand interior thrusts and support door and appurtenant assemblies, except that intermittent duty incinerators not over 85 cubic feet in capacity and burning not over 165 pounds per hour need not have a steel frame if otherwise constructed to conform to paragraph 16.3(a).

(c) Fire brick shall be laid in high temperature cement or fire clay mortar. All common brickwork shall be laid with full, push-filled, cross and bed mortar joints.

(d) No metal stays, lintels or other supports shall be exposed to the interior of the combustion area.

16.4. Incinerator rooms.

(a) Incinerators in which the combined hearth and grate area of the combustion chamber exceeds 7 square feet shall be enclosed within a room separated from other parts of the building by walls, and floor and ceiling assemblies having a fire resistance rating of not less than two hours, with floor of earth or other noncombustible material. Openings to such rooms shall be protected by approved self-closing or automatic fire doors suitable for Class B situations.

(b) Ducts extending from an incinerator room through other parts of a building shall be constructed and protected in accordance with section 13.

16.5. Refuse chutes, terminal rooms or bins.

(a) Rubbish or refuse chutes other than charging chutes shall rest upon substantial noncombustible foundations. Enclosing walls of such chutes shall consist of clay or shale brickwork not less than 8 inches thick or of reinforced concrete not less than 6 inches thick. Such chutes shall extend at least 4 feet above the roof and be covered by a metal skylight glazed with thin plain glass.

(b) Rubbish or refuse chutes shall terminate or discharge directly into a room or bin separated from the incinerator room and from other parts of the building by walls and floor and ceiling assemblies having a fire resistance rating equal to that specified for the chute. Openings to such rooms or bins shall be protected by approved self-closing or automatic fire doors suitable for Class B situations.

(c) Each service opening in a rubbish or refuse chute shall be protected by an approved self-closing fire door suitable for Class B situations or an approved chute door. Every such service opening shall be enclosed in a room or compartment separated from other parts of the building by walls and floor and ceiling assemblies having a fire resistance rating of not less than one hour with openings to such a room or compartment protected by approved fire doors suitable for Class B situations.

16.6. Charging chutes and enclosures.

(a) Where the combustion chamber of an incinerator is charged through the floor above such incinerator, the charging chute shall be constructed of not less than 12 gauge steel casing, lined with not less than 4½ inches of fire brick or equivalent refractory. Such charging chute shall not exceed 6 feet in length measured from the floor opening to the outside of the roof of the incinerator combustion chamber, unless approved means are provided to prevent the charging chute from discharging gases re-

sulting from combustion into the charging room. When a top charging extension is provided, it shall be lined with refractory material not less than 4½ inches thick. The charging chute opening shall be protected by a cover extending beyond the edges of the opening for at least 2 inches on all sides, and lined with not less than 2½ inches of refractory material.

(b) Charging chute floor openings shall be located in a room with walls and floor and ceiling assemblies having a fire resistance rating of not less than two hours and with openings protected by approved self-closing or automatic fire doors suitable for Class A situations, except that where the room is protected by an approved system of automatic sprinklers, the walls and floor and ceiling assemblies may have a fire resistance rating of not less than one hour and the door may be one approved for Class B situations.

16.7. Flue pipes.

(a) The flue pipes or breechings connecting incinerators to chimneys or flues, except as provided in paragraph 16.7(b), shall be constructed of not lighter than 16 gauge steel when they are 12 inches or less in diameter or greatest dimension and of not lighter than 12 gauge steel when they exceed 12 inches in diameter or greatest dimension. In addition, they shall be lined with fire brick not less than 2½ inches thick, laid in high temperature cement or fire clay mortar when they are more than 12 inches but not in excess of 18 inches in diameter or greatest dimension, and with brick not less than 4¼ inches thick when they are over 18 inches in diameter or greatest dimension.

(b) Flue pipes of incinerators specially constructed to produce low flue gas temperatures, and incinerator flue pipes not over 10 inches in diameter and not over 8 feet long may be of flue tile properly supported and insulated, or of other suitable construction without fire brick lining where located entirely within the incinerator room.

(c) Where incinerator flue pipes or breechings lead into and combine with flue pipes or breechings of other appliances such other flue pipes shall also be lined from this point to the chimney as specified in paragraph 16.7(a) for incinerator flue connections, except that lining of this portion may be omitted where the cross-sectional area of such other flue pipe is at least equal to the area of the incinerator flue pipe or breeching and the combined breeching is large enough for full load conditions of both services and will carry flue gases at a temperature not higher than 900 F.

(d) Clearance between incinerator flue pipes or breechings and combustible construction, including plastered constructions having combustible supports, shall be not less than 36 inches.

16.8. Chimneys.

Chimneys for commercial and industrial type incinerators shall be constructed in accordance with nationally recognized good practice. Construction in accordance with Article X of the National Building Code recommended by the National Board of Fire Underwriters shall be considered as in accordance with nationally recognized good practice.

16.9. Expansion chambers and spark arresters.

Incinerators used for the burning of rubbish or other readily combustible solid waste material shall include effective means for arresting sparks and fly particles, such as an expansion chamber, baffle walls, or other effective arrangement, or the flues or stacks of such incinerators shall be provided with an approved spark arrester having openings not greater than ¾ of an inch.

SECTION 17. BLOWER AND EXHAUST SYSTEMS FOR DUST, STOCK AND VAPORS.

17.1. General.

(a) Blower and exhaust systems for dust, stock or vapors hereafter installed as part of or attached to parts of a building shall be constructed and installed to conform to the requirements of this section.

(b) Blower and exhaust systems heretofore installed as part of or attached to parts of a building shall not be altered, extended or enlarged, except in conformity with the requirements of this section.

17.2. Ducts.

(a) Ducts of blower and exhaust system shall be constructed of noncombustible materials.

(b) Metal ducts shall be constructed of steel or iron not thinner than specified in the following table:

	U. S. Gauge	
Diameter of duct, inches	Non-Abrasive Materials	Abrasive Dusts
Up to 8, inclusive	24	20
Over 8 to 18, inclusive	22	18
Over 18 to 30, inclusive	20	16
Over 30	18	14

(c) Changes in the size of ducts shall be made on a taper.

(d) Ducts shall be tight throughout and no openings shall be permitted except those necessary to perform the required functions of the system.

(e) Duct shall be substantially supported. Hangers and brackets shall be of metal.

(f) Ducts carrying flammable vapors or dusts shall have a clearance of not less than 6 inches to combustible material. Ducts operating at elevated temperatures shall have clearances to combustible material in accordance with the following table:

Duct Gas Temperature	Largest Duct Dimension	Clearance
Up to 600° F., incl.	8 in.	8 in.
	Over 8 in.	12 in.
Over 600°-900° F., incl.	8 in.	18 in.
	Over 8 in.	24 in.
Over 900° F.	All ducts lined with refractories	24 in.

(g) Ducts shall not pass through fire walls unless unavoidable. When ducts or the outlets from or inlets to same pass through fire walls they shall be provided with approved automatic fire doors or shutters, on both sides of the wall.

(h) Where ducts pass through walls, floors or partitions the space around the ducts shall be sealed with rope asbestos, mineral wool or other noncombustible material to prevent passage of flame and smoke.

17.3. Fans.

(a) Fans shall be so located and installed as to be readily accessible for repairing, cleaning, inspecting and lubricating.

(b) Fans shall not be located in fire walls, or required two-hour partitions.

(c) When flammable material or vapors are to pass through fans the rotating element shall be of non-sparking material or the casing shall consist of or be lined with such material.

17.4. Grounding.

All metal parts of apparatus, used in systems for the removal of flammable gases or vapors, or systems used for conveying flammable dust, stock or refuse and shafting in connection therewith, shall be electrically grounded in an effective and approved manner.

17.5. Systems for removal of flammable vapors.

(a) In exhaust systems for the removal of flammable vapors, ducts shall lead to the outside of the building in the most direct manner possible.

(b) Outlets to atmosphere shall be kept clear of and away from combustible materials.

17.6. Dust, stock and refuse conveying systems.

(a) Separating or collecting equipment shall be constructed of or be enclosed by steel or other approval noncombustible material. Supports shall be of steel, masonry or concrete.

(b) Dust collecting systems from grinding and other machines which may produce sparks shall not be combined with collecting systems handling linty or other readily flammable dusts.

(c) Discharge ducts of separating and collecting equipment shall have clearances as specified for ducts in section 17.2.

(d) Storage bins or other receptacles which contain materials which form an explosive mixture with air shall be provided with adequate explosion relief vents.

(e) Explosion relief vents on duct systems shall have a cross-sectional area not less than that of the duct vented, and shall lead to the outside of the building. Explosion relief vent openings shall be provided with rupture diaphragms fitted with cutters to accelerate rupture, or equivalent means of relieving pressure.

(f) Explosion relief vents shall not be connected to chimneys or duct systems used for other purposes.

SECTION 18. HEATING AND VENTILATING EQUIPMENT IN HAZARDOUS OCCUPANCIES.

Heating and ventilating equipment in occupancies involving fire hazards from flammable vapors or dusts, or readily combustible fibers or other highly combustible substances shall be so installed and protected as to be safeguarded against fire and explosion hazards in accordance with nationally recognized safe practice. Compliance with applicable standards of the National Board of Fire Underwriters shall be considered as compliance with nationally recognized safe practice.

REFERENCE I.

Gas Appliances Approved For Use With Type B Gas Vents.

With respect to the approval of gas burning appliances under section 1006 of the N. C. Building Code, it is suggested that the building official accept the published listings as shown in the "Gas and Oil Equipment List" of Underwriters' Laboratories, Inc. and the "Directory" of approved gas burning appliances of the American Gas Association Laboratories. Gas burning unit heaters and domestic type gas burning appliances, except incinerators and recessed heaters, which are so listed may be accepted as producing flue gas temperatures not in excess of 550 F. at the outlet of the draft hood. Recessed heaters are permitted to have flue gas temperatures of 550 F. at a point 3 feet 6 inches above the plane of the appliance flue outlet and therefore may produce flue gas temperatures in excess of 550 F. at the outlet of the draft hood. For listings of type B gas vents, see Underwriters' Laboratories, Inc. "Gas and Oil Equipment List" under the heading Flues.

In determining whether to permit the use of type B gas vents for venting boilers and furnaces having flue gas temperatures within the limit above specified, building officials should give consideration to the possibility of a change to solid or liquid fuel, and to the possibility of getting an approved chimney installed in case such a change is made. Where local conditions with respect to gas supply are such that change to other fuel is considered unlikely, or where arrangements can be made so that the building official will be notified of the change from gas to other fuel and so that the requirement for a chimney can then be enforced, it is suggested that the building official may safely permit the use of type B gas vents for venting heating boilers and furnaces having flue gas temperatures within the limit above specified.

REFERENCE II.

Listed Appliances.

With respect to heating appliances to be considered as "approved specifically for installation on a floor constructed of combustible material," or "in floors constructed of combustible material" or "in walls partitions, floors or ceilings constructed of combustible material," or as "approved specifically for installation with lesser clearances than specified," it is suggested that the building official accept the published listings of any nationally recognized testing agency which is qualified and equipped for experimental testing, and which maintains at least an annual inspection program on current production of listed models, and which makes available a published record of such listings in which specific information is included regarding such mounting or clearances.

Listings of gas and oil burning warm air furnaces, oil burning floor furnaces, and oil burning stoves and ranges, conforming to the above conditions are contained in the "Gas and Oil Equipment List" of Underwriters' Laboratories, Inc. Gas burning appliances are listed under the heading Gas-Heating Appliances, oil burning appliances under Oil-Fired Units except oil burning stoves, ranges and room heaters are listed under the heading Oil-Burning Stoves.

Listings of electric ranges conforming to the above conditions are contained in the "List of Inspected Electrical Equipment" of Underwriters' Laboratories, Inc., under the heading Heaters—Ranges. Listings of electric heating furnaces will be found in the same list under the heading Heaters—Furnaces, Electric Central Heating, and radiant heating equipment under the heading Heaters—Radiant Heating Equipment.

Listings of various kinds of gas burning appliances conforming to the above conditions are contained in the "Directory" of approved gas burning appliances of the American Gas Association Laboratories, 1032 East 62nd St., Cleveland 3, Ohio. These listings include central heating boilers and furnaces, domestic ranges, hotel and restaurant ranges, room heaters, unit heaters, and water heaters. Domestic gas ranges are approved for installation with clearances in accordance with the following table:

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
Uninsulated	—	6	6	6	1
Insulated*	Less than 5 in.	½	3	1	1
Insulated	5 in. or more	½	½	1	1
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.

Note.—The latest lists should be consulted in each case. Later editions of the lists of Underwriters' Laboratories, Inc., and of the American Gas Association Laboratories may contain listings conforming to the stated conditions, of other types of heating appliances.

REFERENCE III.

High Pressure Steam and Hot Oil Pipes.

High pressure steam pipes, hot oil pipes, etc., unless suitably insulated, may need greater clearance than one inch as required by section 11, depending on the temperature and diameter of the pipe.

REFERENCE IV.

Supplementary Information.

For information on approved flameproofed fabric for flexible duct connectors as specified in section 13.2(d), see "Fire Protection Equipment List" of Underwriters' Laboratories, Inc., under the heading Fabrics—Flame Retarded.

Additional information on methods of supplying air for combustion and ventilation of oil burning appliances, on kerosene and oil stoves and portable kerosene heaters, on conversion oil burner installation, and on oil tanks, piping and pumps, is given in the Standards for the Installation of Oil Burning Equipment, NBFU No. 31.

Additional information on methods of supplying air for combustion and ventilation of gas burning appliances, on gas pipe installation, and on procedures to place a gas burning appliance in operation is given in the Standards for the Installation of Gas Piping and Gas Appliances in Buildings, NBFU No. 54.

Additional advisory provisions and information on small outdoor waste burners and on outdoor commercial and industrial type incinerators is given in the Standard for Incinerators, NBFU No. 82.

Additional information on smoke removal systems, on smoke detectors, and on fans is given in the Standards for the Installation of Air Conditioning and Ventilating Systems of Other Than Residence Type, NBFU No. 90A.

Additional advisory information on blower and exhaust systems for dust, stock and vapors is given in the Standards for the Installation of Blower and Exhaust Systems for Dust, Stock and Vapor Removal or Conveying, NBFU No. 91.

REFERENCE V.

CHIMNEYS, FLUES AND VENTS.*

SECTION 1000. CHIMNEYS—GENERAL REQUIREMENTS.

1000.1. Height.

(a) Chimneys for low heat appliances shall extend at least 3 feet above the highest point where they pass through the roof of a building and at least 2 feet higher than any portion of the building within 10 feet.

(b) Chimneys for medium heat appliances shall extend not less than 10 feet higher than any portion of any building within 25 feet.

(c) Chimneys for high heat appliances shall extend not less than 20 feet higher than any portion of any building within 50 feet.

(d) Chimneys of flue-fed incinerators shall be of the height specified in section 1005.2(k).

(e) Chimneys of commercial and industrial type incinerators shall be of the height specified in section 1005.3(g).

1000.2. Clearance from combustible material.

Clearance between chimneys and combustible material shall be not less than specified in section 807. (See appendix VII.)

1000.3. Smoke test.

Chimneys shall be proved tight by a smoke test after erection and before being put into use.

SECTION 1001. MASONRY CHIMNEYS—GENERAL REQUIREMENTS.

1001.1. Support.

Masonry chimneys shall be supported on foundations of masonry or reinforced concrete or other noncombustible material having a fire resistance rating of not less than 3 hours.

1001.2. Corbeling.

No chimney shall be corbeled from a wall more than 6 inches; nor shall a chimney be corbeled from a wall which is less than 12 inches in thickness unless it projects equally on each side of the wall; provided that in the second story of 2-story dwellings corbeling of chimneys on the exterior of the enclosing walls may equal the wall thickness. Corbeling shall not exceed one inch projection for each course of brick projected.

*This is article X of the National Building Code, 1955 Edition.

1001.3. Change in size or shape at roof not permitted.

No change in the size or shape of a chimney, where the chimney passes through the roof, shall be made within a distance of 6 inches above or below the roof joists or rafters.

SECTION 1002. MASONRY CHIMNEYS FOR LOW HEAT APPLIANCES.

(Sections 1000 and 1001 also supply)

1002.1. Appliances classed as low heat appliances.

Low heat appliances shall include ranges, heating stoves, warm air heating furnaces, water heaters and hot water heating boilers, steam boilers operating at not over 50 pounds per square inch gauge pressure, steam boilers of not over 10 boiler horsepower regardless of operating pressure, domestic type incinerators, bakery ovens, candy furnaces, coffee roasting ovens, coke ovens, lead melting furnaces, rendering furnaces, stereotype furnaces, wood drying furnaces, and other furnaces classified as low heat appliances in accordance with nationally recognized good practice. Appliances otherwise classed as medium heat appliances may be considered as low heat appliances if not larger than 100 cubic feet in size.

1002.2. Construction.

Masonry chimneys for low heat appliances shall be constructed of solid masonry units or of reinforced concrete. Chimneys in dwellings, chimneys for domestic type low heat appliances and chimneys for building heating equipment for heating a total volume of occupied space not to exceed 25,000 cubic feet shall have walls not less than 4 inches thick. In other buildings and for other low heat appliances the thickness of chimney walls shall be not less than 8 inches, except that rubble stone masonry shall be not less than 12 inches thick.

1002.3. Liners.

(a) Masonry chimneys for low heat appliances shall be lined with approved fire clay flue liners not less than $\frac{5}{8}$ of an inch thick, or with other approved liner of material that will resist without softening or cracking a temperature of 1800 Fahrenheit.

(b) Fire clay flue liners shall be installed ahead of the construction of the chimney as it is carried up, carefully bedded one on the other in Type A, Type B or fire clay mortar with close fitting joints left smooth on the inside.

(c) In masonry chimneys with walls less than 8 inches thick liners shall be separate from the chimney wall and the space between the liner and masonry shall not be filled; only enough mortar shall be used to make a good joint and hold the liners in position.

(d) Flue liners shall start from a point not less than 8 inches below the intake, or, in the case of fireplaces, from the throat of the fireplace. They shall extend, as nearly vertically as possible, for the entire height of the chimney.

1002.4. Two or more flues in one chimney.

(a) Where two flues adjoin each other in the same chimney with only flue lining separation between them, the joints of the adjacent flue linings shall be staggered at least 7 inches.

(b) Where more than two flues are located in the same chimney, masonry wythes at least 4 inches wide and bonded into the masonry walls of the chimney shall be built at such points between adjacent flue linings that there are not more than two flues in any group of adjoining flues without such wythe separation.

1002.5. Cleanout openings.

Where cleanout openings are provided in chimneys they shall be equipped with metal doors and frames arranged to remain tightly closed when not in use.

SECTION 1003. MASONRY CHIMNEYS FOR MEDIUM HEAT APPLIANCES.

(Sections 1000 and 1001 also apply.)

1003.1. Appliances classed as medium heat appliances.

Medium heat appliances shall include annealing furnaces (glass or metal), charcoal furnaces, galvanizing furnaces, gas producers and steam boilers of over 10 boiler horsepower operating at over 50 pounds per square inch gauge pressure when such appliances are larger than 100 cubic feet in size, and other furnaces classified as medium heat appliances in accordance with nationally recognized good practice. Appliances otherwise classed as high heat appliances may be considered as medium heat appliances if not larger than 100 cubic feet in size.

1003.2. Construction.

Masonry chimneys for medium heat appliances shall be constructed of solid masonry units or of reinforced concrete not less than 8 inches thick, except that stone masonry shall be not less than 12 inches thick; and in addition, shall be lined with not less than 4½ inches of fire brick laid on the 4½-inch bed in fire clay mortar, starting not less than 2 feet below the flue pipe entrance and extending for a distance of at least 25 feet above the flue pipe entrance.

SECTION 1004. MASONRY CHIMNEYS FOR HIGH HEAT APPLIANCES.

(Sections 1000 and 1001 also apply.)

1004.1. Appliances classed as high appliances.

High heat appliances shall include billet and bloom furnaces, blast furnaces, brass furnaces, brick kilns, coal gas retorts, cupolas, earthenware kilns, glass furnaces, open hearth furnaces, porcelain baking and glazing kilns and water gas retorts when such appliances are larger than 100 cubic feet in size, and other furnaces classified as high heat appliances in accordance with nationally recognized good practice.

1004.2. Construction.

Masonry chimneys for high heat appliances shall be constructed with double walls of solid masonry units or of reinforced concrete, each not less than 8 inches in thickness, with an air space of not less than 2 inches between them. The inside of the interior walls shall be of fire brick not less than 4½ inches in thickness laid on the 4½-inch bed in fire clay mortar.

SECTION 1005. MASONRY CHIMNEYS FOR INCINERATORS.

1005.1. Domestic type incinerators.

Masonry chimneys for domestic type incinerators shall be constructed in accordance with the requirements for masonry chimneys for low heat appliances, section 1002.

1005.2. Flue-fed incinerators (apartment house type).

(a) The flue of flue-fed incinerators shall serve the incinerator only and be used for no other purpose.

(b) The flue liner shall be straight and plumb and shall be smooth on the inside.

(c) The size of incinerator flues shall be in accordance with the following:

1. Where not more than one service opening is provided, the size of flue shall be not less than 14 by 14 inches or 196 square inches, inside measurements, except that in one family dwellings the size shall be not less than 12 by 12 inches or 144 square inches.

2. Where two to six service openings are provided, the size of flue shall be not less than 18 by 18 inches or 324 square inches, inside measurements.

3. Where seven or more service openings are provided, the size of flue shall be not less than 22 by 22 inches or 484 square inches, inside measurements.

(d) A Chimney serving an incinerator with a combustion chamber having a horizontal combined hearth and grate area of 7 square feet or less shall have walls of clay or shale brickwork not less than 4 inches thick with a lining of 4½ inches of fire brick for a distance of not less than 10 feet above the roof of the combustion chamber; beyond this point chimney walls shall consist of not less than 8 inches of clay or shale brickwork with a standard fire clay flue liner not less than ⅝ inch in thickness extending from the top of the fire brick lining to the top of the chimney.

(e) A chimney serving an incinerator with a combustion chamber having a horizontal combined hearth and grate area exceeding 7 square feet shall have walls of clay or shale brickwork not less than 4 inches thick with a lining of 4½ inches of fire brick for a distance of not less than 40 feet above the roof of the combustion chamber; beyond this point, chimney walls shall consist of not less than 8 inches of clay or shale brickwork with a standard fire clay flue liner extending from the top of the fire brick lining to the top of the chimney.

(f) Other constructions may be used if equivalent to the constructions outlined in the preceding paragraphs, in structural strength, insulating value and ability to withstand thermal expansion and flame impingement.

(g) Fire brick shall be laid in high temperature cement or fire clay mortar.

(h) Clearance between chimneys and combustible material shall be not less than specified in section 807. (See appendix VII.)

(i) A flue that is divided into two channels, one for feeding refuse and the other for the discharge of combustion gases, shall be constructed as specified in this subsection 1005.2.

(j) Chimneys of flue-fed incinerators shall be supported on foundations of masonry or reinforced concrete or other noncombustible material having a fire resistance rating of not less than 3 hours. They shall be so constructed as not to place excessive stress upon the roof of the combustion chamber.

(k) Chimneys of flue-fed incinerators shall extend at least 4 feet above sloping roofs measured from the highest point at which the chimney passes through the roof and at least 8 feet above flat roofs. In either case, the chimney shall extend at least 2 feet higher than any portion of a building within 20 feet.

(l) All flues shall terminate in a substantially constructed spark arrester with openings not greater than ½ inch, or be provided with other suitable means for avoiding discharge of fly particles. Expansion chambers used as a secondary combustion chamber shall be constructed equivalent to that of the incinerator combustion chamber. Those used only for settling shall be of construction equivalent to that of the upper portion of incinerator

chimney with clearances to combustible construction as specified by section 807. (See appendix VII.) Expansion chambers shall be provided with substantial noncombustible supports. Every expansion chamber shall have a vent of cross-sectional area at least equal to that of the flue.

1005.3. Commercial and industrial type incinerators.

(a) Chimneys of commercial and industrial type incinerators, except as provided in the following paragraphs (b) and (c), shall be not less than 8 inches of clay or shale brickwork or reinforced concrete or a metal chimney, lined with fire brick not less than 4½ inches thick for the full height of the chimney.

(b) Subject to approval by the buliding official, commercial and industrial type incinerators may be connected to chimneys constructed of 8 inches of clay or shale brickwork or reinforced concrete lined with fire clay flue liner, or to a metal chimney, where the incinerator is specially constructed to produce low flue gas temperatures.

(c) Other constructions may be used if equivalent to the construction outlined in the preceding paragraphs, in structural strength, insulating value and ability to withstand thermal expansion and flame impingement.

(d) Fire brick and other refractory lining shall be laid in high temperature cement or fire clay mortar.

(e) Clearances between chimneys and combustible material shall be not less than specified in section 807. (See appendix VII.)

(f) Chimneys of commercial and industrial type incinerators shall be supported on foundations of masonry or reinforced concrete or other noncombustible material having a fire resistance rating of not less than 3 hours. They shall be so constructed as not to place excessive stress upon the roof of the combustion chamber.

(g) Chimneys of commercial and industrial type incinerators shall extend at least 4 feet above sloping roofs measured from the highest point at which the chimney passes through the roof and at least 8 feet above flat roofs. In either case, the chimney shall extend at least 2 feet higher than any portion of a building within 20 feet.

(h) Incinerators may be connected to industrial or similar chimneys serving heat-producing appliances provided the cross-sectional area of such chimney is adequate for the combined services and its construction is suitable for the chimney flue gas temperature.

(i) Incinerators used for the burning of rubbish or other readily combustible solid waste material shall include effective means for arresting sparks and fly particles, such as an expansion chamber, baffle walls, or other effective arrangement, or the flues

of such incinerators shall be provided with an approved spark arrester having openings not greater than ¾ inch.

SECTION 1006. FIREPLACES.

(a) Fireplaces shall be constructed of solid masonry or of reinforced concrete with back and sides of the thickness specified in this paragraph, except as provided by the following paragraph: Where a lining of fire brick at least 2 inches thick or other approved lining is provided, the total thickness of back and sides including the lining shall be not less than 8 inches. Where no such lining is provided, the thickness of back and sides shall be not less than 12 inches.

(b) Factory-built fireplaces that are approved as a result of tests and listing by a nationally recognized testing laboratory need not conform to the above paragraph (a) provided they are installed in accordance with the conditions of the approval.

(c) Fireplace hearth extensions shall be provided of approved noncombustible material for all fireplaces. Where the fireplace opening is less than 6 sq. ft., the hearth extension shall extend at least 16 in. in front of, and at least 8 in. beyond each side of the fireplace opening. Where the fireplace opening is 6 sq. ft. or larger, the hearth extension shall extend at least 20 in. in front of, and at least 12 in. beyond each side of the fireplace opening. Where a fireplace is elevated above or overhangs a floor the hearth extension shall also extend over the area under the fireplace.

(d) Fireplaces constructed of masonry or reinforced concrete shall have hearth extensions of brick, concrete, stone, tile or other approved noncombustible material properly supported and with no combustible material against the underside thereof. Wooden forms or centers used during the construction of hearth and hearth extension shall be removed when the construction is completed.

(e) Hearth extensions of approved factory-built fireplaces shall be not less than ⅜ in. thick of asbestos, concrete, hollow metal, stone, tile or other approved noncombustible material. Such hearth extensions may be placed on the sub or finish flooring whether the flooring is combustible or not. The hearth extension shall be readily distinguishable from the surrounding floor.

(f) Clearances between fireplaces of masonry or reinforced concrete and combustible material shall be not less than specified in section 807. (See appendix VII.) Clearances between approved factory-built fireplaces and combustible material shall be not less than specified in the approval.

(g) Spaces between fireplaces and combustible material shall be firestopped as specified in section 807. (See appendix VII.)

SECTION 1007. LABORATORY TESTED FACTORY-BUILT CHIMNEYS.

Factory-built chimneys that are approved as a result of tests and listing by a nationally recognized testing laboratory shall be installed in accordance with the conditions of the approval.

SECTION 1008. METAL CHIMNEYS (SMOKESTACKS).

1008.1. Construction.

(a) Metal chimneys shall be of adequate thickness, properly rivated or welded, and securely supported. Metal shall be galvanized or painted unless suitably corrosion resistant.

(b) Metal chimneys used for high heat appliances as defined in section 1004.1 shall be lined with not less than 4½ inches of fire brick laid in fire clay mortar extending not less than 25 feet above the smoke pipe entrance.

1008.2. Clearances for exterior metal chimneys.

Metal chimneys erected on the exterior of a building shall have sufficient clearance from buildings and structures to avoid overheating combustible material, to permit inspection and maintenance operations on the chimney, and to avoid danger of burns to persons using any nearby exit way, in accordance with the following:

(a) Exterior metal chimneys used only for low heat appliances as defined in section 1002.1 burning gas shall have a clearance of not less than 6 inches from a wall of wood frame construction and from any combustible material.

(b) Exterior chimneys used for low heat appliances as defined in section 1002.1 burning any fuel other than gas shall have a clearance of not less than 12 inches from a wall of wood frame construction and from combustible material.

(c) Exterior chimneys used for medium heat appliances as defined in section 1003.1 shall have a clearance of not less than 24 inches from a wall of wood frame construction and from any combustible material.

(d) Exterior metal chimneys over 6 inches in outside diameter shall have a clearance of not less than 2 inches, and those over 18 inches in diameter a clearance of not less than 4 inches from a building wall of other than wood frame construction.

(e) No portion of an exterior metal chimney shall be nearer than 24 inches to any door or window or to any exit way, unless insulated or shielded in an approved manner to avoid burning a person who might touch the chimney.

1008.3. Enclosure of interior metal chimneys.

(a) Where a metal chimney extends through any story of a building above that in which the appliances connected to the chimney are located, it shall be enclosed in such upper stories with walls of noncombustible construction having a fire resistance rating of not less than one hour.

(b) The enclosure shall provide a space on all sides of the chimney sufficient to permit inspection and repair.

(c) The enclosing walls shall be without openings, except doorways equipped with approved self-closing fire doors at various floor levels for inspection purposes.

1008.4. Passage through roof.

(a) Where a metal chimney serving only low heat appliances as defined in section 1002.1 passes through a roof constructed of combustible material, it shall be guarded by a ventilating thimble of galvanized iron or approved corrosion resistant metal, extending not less than 9 inches below and 9 inches above the roof construction, and of a size to provide not less than 6 inches clearance on all sides of the chimney; or the combustible material in the roof construction shall be cut away so as to provide not less than 18 inches clearance on all sides of the chimney, with any material used to close up such opening entirely noncombustible.

(b) Where a metal chimney serving a medium heat appliance as defined in section 1003.1 passes through a roof constructed of combustible material, it shall be guarded by a ventilating thimble of galvanized iron or approved corrosion resistant metal, extending not less than 9 inches below and 9 inches above the roof construction, and of a size to provide not less than 18 inches clearance on all sides of the chimney.

1008.5. Location in ventilating ducts restricted.

Metal chimneys shall not be carried up inside of ventilating ducts unless such ducts are constructed as required by this article for chimneys and are used solely for exhaust of air from the room or space in which the appliance served by the chimney is located.

SECTION 1009. GAS VENTS.

1009.1. Types of vents which may be used.

Gas appliance vents that do not conform to the requirements of this article for chimneys shall be of one of the following types installed as required by this section.

(a) **Type B gas vents**—Vent piping of noncombustible, corrosion resistant material approved as a result of tests and listing by a nationally recognized testing laboratory for venting of gas appliances.

(b) Type BW gas vents—Vent piping of noncombustible, corrosion resistant material approved as a result of tests and listing by a nationally recognized testing laboratory for venting recessed gas heaters.

(c) Type C gas vents—Vent piping of sheet copper of not less than No. 24 gauge or of galvanized iron of not less than No. 20 gauge or of other approved noncombustible corrosion resistant material.

1009.2. Height.

Gas vents shall extend at least 2 feet above the highest point where they pass through the roof of a building and at least 2 feet higher than any portion of the building within 10 feet, except that gas vents need not comply with this provision when equipped with an approved device which assures proper and effective venting as installed.

1009.3. Use limits.

(a) Type B gas vents shall be used only with approved gas appliances which produce flue gas temperatures not in excess of 500 F. They shall not be used for venting:

(1) Incinerators;

(2) Appliances which may be converted readily to the use of solid or liquid fuel;

(3) Boilers and furnaces, other than attic furnaces, except where specific approval is obtained from the building official for use of type B gas vents.

(b) Type BW gas vents shall be used only with approved recessed gas heaters.

(c) Type C gas 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 vents shall not pass through any attic or concealed space nor through any floor; but may be used to vent attic furnaces.

1009.4. Marking of gas vents.

Gas vents which are not suitable for use with solid or liquid fuel burning appliances shall be plainly and permanently labeled:

"This flue is for appliances which burn gas only," unless permission to omit this marking is granted by the building official.

1009.5. Installation of type B and type BW gas vents.

Type B and type BW gas vents shall be installed in full compliance with the terms of their approval.

1009.6. Installation of type C gas vents.

(a) Type C gas vents shall be installed with clearances from combustible material of not less than 9 inches except that for vertical portions of the vent the clearance may be 6 inches.

(b) Where a type C gas vent goes through an exterior wall constructed of combustible material, except as provided in subparagraph (4), it shall guarded at the point of passage by a ventilating metal thimble not smaller than the following:

(1) For gas burning appliances, except floor furnaces and incinerators, that have been tested by an approved agency and found to have flue gas temperatures not exceeding 550 F. —4 inches larger in diameter than the vent pipe, unless there is a run of not less than 6 feet of vent pipe 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 pipe;

(2) For gas burning floor furnaces and for all gas burning appliances that have not been found by test by an approved agency to have flue gas temperatures of 550 F. or less—6 inches larger in diameter than the vent pipe;

(3) For gas burning incinerators—12 inches larger in diameter than the vent pipe.

(4) In lieu of thimble protection all combustible material in the wall shall be cut away from the vent pipe a sufficient distance to provide the clearance required from such vent pipe to combustible material, with any material used to close up such opening entirely noncombustible.

(c) Where a type C gas vent goes through a roof constructed of combustible material it shall be guarded at the point of passage as specified for passage through a combustible exterior wall by section 1009.6(b), or by a noncombustible non-ventilating thimble not less than 4 inches larger in diameter 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.

REFERENCE VI.

SECTION 807. FRAMING AROUND CHIMNEYS AND FIREPLACES.*

(a) All wood beams, joists and studs shall be trimmed away from chimneys and fireplaces. Headers, beams, joists and studs shall be not less than 2 inches from the outside face of a chimney or from masonry enclosing a flue. Headers supporting trimmer arches at fireplaces shall be not less than 20 inches from the face of the chimney breast. Trimmers shall be not less than 6 inches from the inside face of the nearest flue lining.

(b) A clearance of not less than 4 inches shall be provided between the exterior surface of chimneys for commercial and industrial type incinerators and combustible material.

(c) No woodwork shall be placed within 4 inches of the back face of a fireplace; nor shall combustible lathing, furring or plaster grounds be placed against a chimney at any point more than 1½ inches from the corner of the chimney; but this shall not prevent plastering directly on the masonry or on metal lath and metal furring; nor shall it prevent placing chimneys for low heat appliances entirely on the exterior of a building against the sheathing.

(d) The clearance between woodwork and a factory-built fireplace approved as a result of tests by a nationally recognized testing laboratory need not comply with paragraph (c) of this section provided the factory-built fireplace is installed in accordance with the conditions of approval.

(e) No woodwork shall be placed within 6 inches of a fireplace opening. Woodwork above and projecting more than 1½ inches from a fireplace opening shall not be placed less than 12 inches from the top of a fireplace opening.

(f) All spaces between chimneys and wood joists, beams or headers shall be firestopped by placing noncombustible material to a depth of one inch at the bottom of such spaces.

(g) All spaces back of combustible mantels shall be filled with noncombustible material.

*From Article VIII of the National Building Code, 1955 Edition.

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