



N.J.A.C. 12:121



HEAT PRODUCING APPLIANCES AND AIR CONDITIONING SYSTEMS



Effective January 1, 1970

STATE OF NEW JERSEY
DEPARTMENT OF LABOR & INDUSTRY
BUREAU OF ENGINEERING & SAFETY
Trenton, N.J.

LIST OF PUBLICATIONS

NEW JERSEY ADMINISTRATIVE CODE

The Administrative Procedures Act of 1968 established the New Jersey Administrative Code (N.J.A.C.) effective September 1, 1969. Safety regulations previously identified by a regulation number must now be cited by N.J.A.C. citation. The citation consists of N.J.A.C., title number, and chapter number; for example, N.J.A.C. 12:120. The establishment of the N.J.A.C. did not change the substance or arrangement of any existing safety regulation. For the convenience of those who already have copies of our safety regulations, a Conversion Table on the inside back cover lists the regulation numbers in consecutive order and shows the newly assigned chapter numbers.

The following list shows the chapter numbers of the Administrative Code, the short titles, former safety regulation numbers and effective dates of all safety regulations of the Bureau of Engineering and Safety as of January, 1970.

N.J.A.C. TITLE 12—LABOR AND INDUSTRY

Subtitle K—Bureau of Engineering and Safety

Part 1

WORKER HEALTH AND SAFETY ACT

- Chapter 110. Plan Filing, SR No. 30—7/1/69.
- Chapter 115. The Standard Building Code of New Jersey—1/12/54.
- Chapter 120. Sanitation, SR No. 40—12/1/69.
- Chapter 121. Heat Producing Appliances and Air Conditioning Systems, SR No. 41—1/1/70.
- Chapter 122. Local Exhaust Systems, SR No. 19—6/28/51.
- Chapter 130. Labeling of Hazardous Chemicals, SR No. 2—12/1/67.
- Chapter 131. Threshold Limit Values, SR No. 3—12/1/67.
- Chapter 132. Wet Nitrocellulose, SR No. 57—12/1/69.
- Chapter 140. Conveyors and Cableways, SR No. 5—12/1/67.
- Chapter 141. Woodworking Machinery, SR No. 6—12/1/67.
- Chapter 142. Extractors and Centrifuges, SR No. 9—12/1/69.
- Chapter 143. Mechanical Presses, SR No. 71—12/1/69.
- Chapter 144. Abrasive Wheels, SR No. 72—12/1/69.
- Chapter 145. Mechanical Power Transmission Apparatus, SR No. 4—10/1/58.
- Chapter 146. Machinery with Rolls, SR No. 8—4/10/59.
- Chapter 147. Industrial Trucks—5/1/70.
- Chapter 148. Overhead and Gantry Cranes—5/1/70.
- Chapter 160. Welding and Cutting, SR No. 11—7/1/69.
- Chapter 161. Smoking, SR No. 1—5/1/70.
- Chapter 162. Electrical Installations—5/1/70.
- Chapter 170. Work in Confined Spaces, SR No. 10—12/1/67.
- Chapter 171. Short-Rise Hydraulic Material Handling Lifts—10/15/53.

(Continued on inside back cover)

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NJ/KAS

LI/SI

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(STATE OF) NEW JERSEY.
DEPARTMENT OF LABOR AND INDUSTRY.

BUREAU OF ENGINEERING AND SAFETY.

TRENTON, NEW JERSEY

DIVISION OF LABOR.

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TABLE OF CONTENTS

	PAGE
FOREWORD	1
 SECTION 1—GENERAL PROVISIONS	
1.1. Purpose	3
1.2. Scope	3
1.3. Validity	3
1.4. Existing Installations	3
1.5. Accessibility	3
1.6. Air for Combustion and Ventilation	4
1.7. Appliances on Roofs	6
1.8. Location Near Exits	7
1.9. Hazardous Locations	7
1.10. Appliance Enclosures	7
1.11. Chimneys, Fireplaces and Venting Systems	7
1.12. Other Applicable Standards on Heat Producing Appliances	7
1.13. Air Pollution	8
1.14. Fired and Unfired Pressure Vessels	8
1.15. Plan Filing	8
1.16. Effective Date	8
SECTION 2—DEFINITIONS	9
 SECTION 3—RESIDENTIAL TYPE BOILERS	
3.1. Definition	16
3.2. Mounting	16
3.3. Clearances	17
3.4. Controls	21
 SECTION 4—RESIDENTIAL TYPE CENTRAL FURNACES	
4.1. Definitions	22
4.2. Mounting	22
4.3. Clearances	23
4.4. Control	23
4.5. Attic Furnaces	24
4.6. Outdoor Installations	24
 SECTION 5—RESIDENTIAL TYPE FLOOR FURNACES	
5.1. Definition	25
5.2. Installation	25

5.3	Support	25
5.4	Clearances	25
5.5	Access	25
5.6	Location of Thermostat	26
5.7	Upper Floor Installation	26
5.8	First or Ground Floor Installation	26
5.9	Placement	26

SECTION 6—RESIDENTIAL TYPE ROOM HEATERS

6.1	Definitions	27
6.2	Mounting	27
6.3	Clearances	28
6.4	In Living Quarters	28

SECTION 7—RESIDENTIAL TYPE WATER HEATERS

7.1	Definition	29
7.2	Mounting	29
7.3	Clearances	29
7.4	Controls	29

SECTION 8—RESIDENTIAL TYPE WALL FURNACES

8.1	Definition	30
8.2	Installation	30

SECTION 9—AIR CONDITIONING APPLIANCES AND HEAT PUMPS

9.1	Definitions	31
9.2	Installation	31
9.3	Refrigeration Coils with Central Furnaces	31
9.4	Cooling Units Used With Heating Boilers	32
9.5	Controls for Heat Pumps	32

SECTION 10—INDUSTRIAL TYPE LOW HEAT APPLIANCES

10.1	Definitions	33
10.2	Mounting	33
10.3	Clearances	34

SECTION 11—UNIT HEATERS

11.1	Definitions	36
11.2	Floor Mounted Unit Heaters	36
11.3	Suspended Type Unit Heaters	36
11.4	Steam or Hot Water Unit Heaters	37

SECTION 12—RESTAURANT TYPE COOKING EQUIPMENT	
12.1 Definition	38
12.2 Mounting of Floor Type Restaurant Type Cooking Equipment	38
12.3 Clearances of Floor Mounted Restaurant Type Cooking Equipment	39
12.4 Ventilation of Restaurant Type Cooking Equipment ..	40
SECTION 13—INDUSTRIAL TYPE MEDIUM-HEAT APPLIANCES	
13.1 Definition	41
13.2 Mounting	41
13.3 Clearances	41
13.4 Ventilation	41
SECTION 14—INDUSTRIAL TYPE HIGH-HEAT APPLIANCES	
14.1 Definition	43
14.2 Mounting	43
14.3 Clearances	43
14.4 Ventilation	43
SECTION 15—DIRECT GAS-FIRED MAKEUP AIR HEATERS	
15.1 Definition	44
15.2 Use	44
15.3 Design	44
15.4 Controls	44
15.5 Installation	45
SECTION 16—INFRA-RED RADIANT HEATERS	
16.1 Definition	46
16.2 Design	46
16.3 Combustion and Ventilation Air	46
16.4 Installation	46
SECTION 17—INCINERATORS	
17.1 Definitions	47
17.2 Performance	47
17.3 Auxiliary Burners	47
17.4 Combustion Chambers	50
17.5 Mounting	50
17.6 Clearances	51
17.7 Incinerator Rooms	51
17.8 Refuse Chutes, Terminal Rooms or Bins	52

17.9 Chimney Connectors	53
17.10 Chimneys	54

SECTION 18—STEAM AND HOT WATER PIPES

18.1 Application	55
18.2 Clearances	55
18.3 Protection	55
18.4 Antifreeze Solutions for Radiant Heating Coils	55

SECTION 19—RESIDENTIAL TYPE WARM AIR HEATING AND AIR CONDITIONING SYSTEMS

19.1 Application	56
19.2 Definitions	56
19.3 Supply Systems-Construction	56
19.4 Clearances from Horizontal Supply Ducts	58
19.5 Clearances from Vertical Ducts, Risers, Boots and Register Boxes	59
19.6 Pipeless Furnace Registers	60
19.7 Heating Panels	60
19.8 Use of Underfloor Space as Supply Plenum	61
19.9 Use of Concealed Ceiling Spaces as Supply or Return Plenums	62
19.10 Return Ducts	62

SECTION 20—WARM AIR HEATING, AIR CONDITIONING, AIR COOLING AND VENTILATING DISTRIBUTION SYS- TEMS OF OTHER THAN RESIDENTIAL TYPE

20.1 Application	64
20.2 Construction of Ducts	64
20.3 Clean-Out Openings in Ducts	66
20.4 Installation of Ducts	66
20.5 Clearances from Warm Air Ducts	69
20.6 Automatic Fire Doors and Dampers	69
20.7 Fresh Air Intakes	70
20.8 Air Inlet and Outlet Openings	70
20.9 Air Filters	70
20.10 Controls	70

APPENDIX A—AVAILABILITY OF REFERENCED STANDARDS 71 AND PUBLICATIONS

FOREWORD

This is a new Chapter of Title 12 of the New Jersey Administrative Code on the subject of heat producing appliances and air conditioning systems.

This Chapter establishes reasonable standards for the installation of heat producing appliances in places of employment for the protection of the health and safety of employees.

This Chapter is promulgated by the Commissioner of Labor and Industry of the State of New Jersey, under authority vested in him by Section 9 of the Worker Health and Safety Act, P.L. 1965, Chapter 154, N.J.S.A. 34:6A, as follows:

The commissioner shall make and promulgate rules and regulations reasonably necessary to implement the purposes of this act. Such rules and regulation shall have the force and effect of law and shall be enforced in the manner provided in this act . . .

The same statute provides authority for the Commissioner to grant exceptions from the rules and regulations in accordance with Section 23, as follows:

The commissioner shall have the power and authority to grant exceptions from the literal requirements of rules and regulations promulgated under this act. Such exception shall be granted in any particular case only where it is clearly evident that it is necessary to prevent undue hardship or where existing conditions prevent compliance. In no case shall any exception be granted unless in the opinion of the commissioner reasonable protection of the health and safety of workers and the public will be maintained hereby. An application for an exception shall be filed in writing with the commissioner, setting forth specifically the requirements of the rules and regulations from which an exception is desired and the reason why enforcement of the applicable provisions of the rules and regulations is unreasonable. The commissioner shall grant or deny the exception within 30 days from the date of receipt by him of the application. The commissioner shall maintain a record of all exceptions granted and shall make such record reasonably available for public examination and shall mail a copy of all rulings granting exceptions to the members of the board.

Under Title 34, Chapter 7 of the Revised statutes, originally enacted in 1935, construction of containers (Pressure Vessels) is regulated by the New Jersey Board of Boiler, Refrigeration and Pressure Vessels rules. This board operates as part of the Mechanical Inspection Bureau in the Division of Labor, Department of Labor and Industry. Nothing contained in this Chapter is intended to be in conflict with

or less restrictive than the current rules promulgated by the board and approved by the Commissioner.

Prior to promulgation, this Chapter was submitted to the New Jersey State Industrial Safety Committee, Public Hearing, and the New Jersey State Industrial Safety Board in accordance with the requirements of the Worker Health and Safety Act.

All standards and publications, other than the Chapters of Title 12, N.J.A.C., referenced in this Chapter are available for inspection or purchase in accordance with Appendix A. Chapters of Title 12, N.J.A.C. are available in accordance with the back cover of this publication.

SECTION 1

GENERAL PROVISIONS

1.1 PURPOSE.

- a. This Regulation is intended to prescribe requirements consistent with accepted engineering practice for reasonable safety to life and property from the fire, explosion, and health hazards involved in the installation and use of heat producing appliances, heating, ventilating and air conditioning systems.

1.2 SCOPE.

- a. This Chapter shall apply to the installation of heat producing appliances, heating, ventilating, and air conditioning systems in any place of employment subject to the Worker Health and Safety Act, P.L. 1965, Chapter 154, N.J.S.A. 34:6A.

1.3 VALIDITY.

- a. Nothing in this Chapter shall be construed to prevent the enforcement of other rules, regulations and codes of the Bureau which prescribe more restrictive requirements.
- b. Should any section, paragraph, sentence, or word of this Chapter be declared for any reason to be invalid, such decision shall not affect the remaining portions of this Chapter.

1.4 EXISTING FACILITIES.

- a. Heat producing appliances or air conditioning systems in use before the effective date of this Chapter may be continued in service unless the continued operation of such facilities constitute a serious and substantial threat to the health and safety of employees.
- b. Maintenance of existing facilities shall be in conformance with this Chapter.

1.5 ACCESSIBILITY.

- a. The installation of heat producing appliances shall in all cases be such as to make them accessible for cleaning, operation and maintenance.

1.6 AIR FOR COMBUSTION AND VENTILATION.

a. General

1. Requirements for air are intended to apply to appliances that are installed in buildings and which need air for combustion, ventilation and draft hood dilution from spaces within the building. They are not intended to apply to: 1) sealed combustion system appliances which are constructed and installed so that all air for combustion is derived from the outside atmosphere and all flue gases are discharged to the outside atmosphere, or 2) enclosed furnaces which incorporate an integral total enclosure and use only outside air for combustion and draft hood dilution.
2. Appliances shall be installed in a location in which the facilities for ventilation permit satisfactory combustion of fuel, proper venting and the maintenance of ambient temperature at safe limits under normal conditions of use. Appliances shall be located so as not to interfere with proper circulation of air within the closed space. When buildings are so tight that normal infiltration does not meet air requirements, outside air shall be introduced.
3. Air for combustion for heat producing appliances shall be in addition to the ventilation requirements of the occupancy.
4. A heat producing appliance not connected to a chimney, flue or vent using gaseous, liquid or solid fuel shall not be permitted in any location having less than one air change per hour.
5. Air intakes shall be located so that air for combustion and ventilation does not present a potential flammable or toxic hazard.

b. Appliances Located in Unclosed Spaces

1. In unclosed spaces in buildings of frame construction, infiltration normally is adequate to provide air for combustion, ventilation and draft hood dilution.
2. If the unclosed space is within a building of unusually tight construction, air for combustion, ventilation and draft hood dilution shall be obtained from outdoors from spaces freely communicating with the outdoors. Under these conditions a permanent opening or openings having a total free area of not less than one square inch per 5,000 Btu per hour of total input rating of all appliances shall be provided. Ducts used to convey makeup air from the outdoors shall be of the same cross sectional area as the free area of the openings to which they connect. Such ducts connected to the outside air only may be connected to the cold air return of the heating system. The minimum dimension of rectangular air ducts shall be not less than 3 inches.

c. Appliances Located In Closed Spaces With All Air From Inside Building

1. The closed space shall be provided with two permanent openings, one near the top of the enclosure and one near the bottom. Each opening shall have a free area of not less than one square inch per 1,000 Btu per hour of the total input rating of all appliances in the enclosure, freely communicating with interior areas having in turn adequate infiltration from the outside.

d. Appliances Located In Closed Spaces With All Air From Outdoors

1. The closed space shall be provided with two permanent openings one in or near the top of the enclosure and one in or near the bottom. The openings shall communicate directly, or by means of ducts, with outdoors.
2. When directly communicating with outdoors or by means of vertical ducts, each opening shall have a free area of not less than one square inch per 4,000 Btu per hour of total input rating of all appliances in the enclosure. If horizontal ducts are used, each opening shall have a free area of not less than one square inch per 2,000 Btu per hour of total input of all appliances in the enclosure.
3. Ducts shall be of the same cross-sectional area as the free area of the openings to which they connect. The minimum dimension of rectangular air ducts shall be of not less than 3 inches.

e. Appliances Located In Closed Spaces With Ventilation Air From Inside Building-Combustion and Draft Hood Dilution Air From Outdoors.

1. The enclosure shall be provided with two openings for ventilation, located and sized as described in 1.6.c. In addition, there shall be one opening directly communicating with outdoors or to such spaces (crawl or attic) that freely communicate with outdoors. This opening shall have a free area of not less than one square inch per 5,000 Btu per hour of total input of all appliances in the enclosure. A duct used to convey make-up air shall be of the same cross-sectional area as the free area of the opening required. Such ducts connected directly to outdoor air only may be connected to the cold air return of the heating system. The minimum dimension of rectangular air ducts shall be no less than 3 inches.

f. Louvers And Grilles

1. In calculating free area in 1.6.b through 1.6.e, consideration shall be given to the blocking effect of louvers, grilles or screens protecting openings. Screens used shall not be smaller than 1/4 inch mesh. If the free area through a design of louver or grille is known, it shall be used in

calculating the size opening required to provide the free area specified. If the design and free area is not known, it shall be assumed that wood louvers will have 20-25 per cent free area and metal louvers and grilles will have 60-75 per cent free area.

g. Specially Engineered Installations

1. The size of combustion air openings specified in 1.6.c through 1.6.e shall not govern when special engineering assures an adequate supply of air for combustion and ventilation.

h. Process Air

1. In addition to air needed for combustion and ventilation, sufficient process air shall be provided as required for: cooling equipment or material, controlling dew point, heating, drying, oxidation or dilution, safety exhaust, draft hood operation, odor control and compressors.

1.7 APPLIANCES ON ROOFS.

- a. Appliances installed on roofs shall be listed for outdoor installation or shall be designed to withstand atmospheric and climatic conditions in the areas in which they are to be installed.
- b. Roofs on which appliances are to be installed shall be capable of supporting the additional load or shall be reinforced to support the additional load.
- c. Appliances shall be installed on a well drained surface.
- d. The appliance shall be separated from the edge of a roof or similar hazard by a clearance of at least 6 feet; or by rigidly fixed rails, guards, parapets, or other building structures at least 4 feet in height.
- e. Each appliance shall have an accessible disconnect switch and a 110-120 volt, a-c grounding type, weatherproof type, convenience outlet on the roof near the appliance. The convenience outlet shall be on the supply side of the disconnect switch.
- f. When water stands on the roof at the appliance or in the passageways to the appliance, or when the roof is of a design having a water seal, a suitable platform or walkway or both shall be provided above the water line.
- g. Buildings of more than one story in height shall have an inside means of access to the roof or be provided with a fire escape stair.
- h. The inside means of access shall be permanent, or foldaway, inside stairway or ladder, terminating in an enclosure, scuttle or trap doors, which shall be at least 24 inches by 24 inches in size and shall open easily and safely under

all conditions, especially snow, and shall be constructed so as to permit access from the roof side unless deliberately locked on the inside. The access opening shall be protected as provided in 1.7.d.

- i. Proper permanent lighting shall be provided for the roof access. The switch for such lighting shall be located near the access means leading to the roof.
- j. When climatic or safety conditions warrant, protection from the weather shall be provided either by the design or the appliance itself or by an enclosure. This enclosure shall permit easy entry and movement, shall be of reasonable height, and shall have at least 2 feet of clearance to either side of the service access panel of the appliance.

1.8 LOCATION NEAR EXITS.

- a. Heat producing appliances shall not obstruct exits or any aisle or passage used as a means of egress.

1.9 HAZARDOUS LOCATIONS.

- a. Heat producing appliances burning fuels shall not be located in hazardous areas containing flammable vapors or dusts, readily combustible fibers or other highly combustible substances except when the equipment is entirely enclosed as indirect fired equipment, the enclosing surface of which does not develop temperatures which would produce ignition in the area.

1.10 APPLIANCE ENCLOSURES.

- a. Industrial type high-heat and medium-heat appliances when installed within buildings shall be enclosed as provided by Chapter 115, The Standard Building Code of New Jersey of Title 12, N.J.A.C.

1.11 CHIMNEYS, FIREPLACES AND VENTING SYSTEMS.

- a. The design, construction and installation of chimneys, fireplaces, flues and venting systems shall be in accordance with 1.11 and the Standard for Chimneys, Fireplaces and Venting Systems, NFPA No. 211-1968.

1.12 OTHER APPLICABLE STANDARDS ON HEAT PRODUCING APPLIANCES.

- a. The installation of heat producing appliances and other pertinent equipment not otherwise covered by this Chapter shall conform to:

Oil Burning Equipment, NFPA No. 31-1968.

Gas Appliances and Gas Piping, NFPA No. 54-1969

Gas Piping and Gas Equipment on Industrial Premises and Certain Other Premises, NFPA No. 54A-1969

Fuel Oil and Natural Gas Fired Watertube Boiler-Furnaces, One Burner, NFPA No. 85-1967

Natural Gas Fired Public Utility Boiler-Furnaces, NFPA No. 85B-1969

Fuel Oil Fired Multiple Burner Boiler-Furnaces, NFPA No. 85D-1969

Ovens and Furnaces, NFPA No. 86A-1969

1.13 AIR POLLUTION.

- a. All appliances and systems covered by this regulation shall comply with all requirements of the New Jersey Air Pollution Control Code.

1.14 FIRED AND UNFIRED PRESSURE VESSELS.

- a. Fired and unfired pressure vessels shall comply with the requirements of the Mechanical Inspection Bureau.

1.15 PLAN FILING.

- a. Plan filing for projects involving heat producing appliances shall be in accordance with Chapter 110, Plan Filing of Title 12, N.J.A.C.

1.16 EFFECTIVE DATE.

- a. This Chapter shall take effect on January 1, 1970.

SECTION 2

DEFINITIONS

AIR CONDITIONING.

The process by which the temperature, humidity, movement, cleanliness, and odor of air in buildings and structures used for human occupancy are controlled.

AIR CONDITIONING APPLIANCE.

See 9.1.a.

AIR DUCT.

CLASS 1 AIR DUCT.

See 19.2.a.

CLASS 2 AIR DUCT.

See 19.2.b.

AIR POLLUTION CONTROL CODE

A regulation of:
N.J. Department of Health
Division of Clean Air and Water
Trenton, New Jersey

APPLIANCE.

Any device designed or constructed for the generation of heat or cooling from solid, liquid, or gaseous fuel or electricity.

APPROVED.

Acceptable to the Commissioner. Devices having been tested and accepted for a specific purpose by a nationally recognized testing agency may be deemed to be acceptable.

BOILER.

HIGH PRESSURE BOILER.

A closed vessel in which steam or other vapor to be used externally to itself, is generated at a pressure of more than 15 pounds per square inch gauge by the direct application of heat.

INDUSTRIAL TYPE BOILER.

See 10.1.a.

LOW PRESSURE BOILER.

A steel or cast iron heating boiler in which the maximum allowable working pressure is limited to 15 pounds per square inch for steam and 30 pounds per square inch for hot water heating boilers.

RESIDENTIAL TYPE BOILER.	See 3.1.a.
BUREAU.	The Bureau of Engineering and Safety Division of Labor Department of Labor and Industry State of New Jersey
CENTRAL WARM AIR HEATING SYSTEM.	A heating system consisting of heat exchanger with an outer casing or jacket, or an electric heating unit, connected to a supply system and a return system.
CHIMNEY.	One or more passageways, vertical or nearly so, for conveying flue gases to the outside atmosphere.
FACTORY BUILT CHIMNEY.	A chimney composed of factory-built components assembled in accordance with the listing to form the completed chimney.
MASONRY CHIMNEY.	A chimney of solid masonry units, bricks, stones, listed masonry units or reinforced concrete, lined with suitable flue liners.
METAL CHIMNEY.	A chimney constructed of metal.
CHIMNEY CONNECTOR.	The pipe which connects a fuel burning appliance to a chimney.
CLEARANCE.	The distance between a heat-producing appliance, chimney, chimney connector, vent, vent connector, plenum, or other surfaces.
CLOTHES DRYER, COMMERCIAL TYPE.	See 10.1.b.
COMBUSTIBLE MATERIAL.	Materials adjacent to or in contact with heat-producing appliances, chimney connectors and vent connectors, steam and hot-water pipes, and warm-air ducts, means material made of or surfaced with wood, compressed paper, or plant fibers, or material that will ignite and burn or disintegrate under the influence of heat. Such material shall be treated the same as combustible even though flameproofed, fire-retardant treated, or plastered. Gypsum or other wall-boards that are surfaced with combustible material are classified as combustible.

COMMISSIONER.

Commissioner of the Department of Labor and Industry or his authorized representative.

DAMPER, FIRE.

A damper arranged to seal off air flow automatically through part of an air duct system, so as to restrict the passage of heat.

DEPARTMENT.

Department of Labor and Industry.

**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.

DISTRIBUTION SYSTEM.

A supply system and a return system for conveying warm or air conditioned air.

DRAFT HOOD.

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

EMPLOYEE.

Any person engaged in service to an employer for wages, salary or other compensation.

EMPLOYER.

Any person or corporation, partnership, individual proprietorship, joint venture, firm, company, or legal entity who engages the services of an employee and who pays his wages, salary or other compensation, and any person exercising supervision of employees on an employer's behalf.

**FIRE RESISTANCE
RATING.**

The time in hours that the material or construction will withstand the standard fire exposure as determined by a fire test made in conformity with the Standard Methods of Fire Tests of Building Construction and Materials, ASTM E119 - 1967.

FORCED AIR SYSTEM.

A central warm air heating system that is equipped with a fan or blower which provides the primary means for circulation of air.

FURNACE, CENTRAL WARM AIR RESIDENTIAL TYPE.	See 4.1.a.
FORCED AIR TYPE.	See 4.1.a.1.
GRAVITY TYPE.	See 4.1.a.2.
FURNACE, DOWN FLOW, RESIDENTIAL TYPE.	See 4.1.b.
FURNACE, DUCT, RESIDENTIAL TYPE.	See 4.1.c.
FURNACE, FLOOR, RESIDENTIAL TYPE.	See 5.1.a.
FURNACE, HORIZONTAL, RESIDENTIAL TYPE.	See 4.1.c.
FURNACE, UP FLOW, RESIDENTIAL TYPE.	See 4.1.e.
GAS VENT.	A passageway, vertical or nearly so, composed of listed factory built components assembled in accordance with the listing for conveying flue gases from gas appliances or vent connectors to the outside atmosphere.
TYPE B GAS VENT.	A gas vent for venting gas appliances with draft hoods listed for use with Type B gas vents.
TYPE BW GAS VENT.	A gas vent for venting listed gas fired wall furnaces.
GRAVITY SYSTEM.	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.
HAZARDOUS AREA.	An area classified as a hazardous location under the various Chapters of Title 12, N.J.A.C.
HEAT EXCHANGER, DIRECT.	A heat exchanger in which heat generated in the combustion chamber of the appliance is transferred directly through walls of the heat exchanger to the heating medium (such as air, steam, or water) held in close contact with the combustion-chamber walls. It is a self-contained combustion and heat-transfer device, hence a direct heat-transfer device.

HEAT EXCHANGER, INDIRECT.	A heat exchanger which encloses or contains a heating medium (such as air, steam or water), the heat from which is transferred to another heating medium separately contained in close contact with or directed through the heat exchanger. It is an indirect heat-transfer device.
HEAT PUMP.	See 9.1.b.
INCINERATOR.	See 17.1.a.
INDUSTRIAL APPLIANCE.	
HIGH HEAT APPLIANCE.	See 14.1.a.
LOW HEAT APPLIANCE.	See 10.1.a.
MEDIUM HEAT APPLIANCE.	See 13.1.a.
INFRA-RED RADIANT HEATER.	See 16.1.a.
LABELED.	Equipment or materials to which has been attached a label of a nationally recognized testing laboratory that maintains periodic inspection of production of labeled equipment or materials and by whose labeling is indicated compliance with nationally recognized standards on the conduct of tests to determine suitable usage in a specified manner.
LISTED.	Equipment or materials included in a list published by a nationally recognized testing agency that maintains periodic inspection of production of listed equipment or materials and whose listing states either that the equipment or material meets nationally recognized standards or has been tested and found suitable for use in a specified manner.
MAKEUP AIR HEATER, DIRECT GAS FIRED.	See 15.1.a.
NATIONALLY RECOGNIZED TESTING AGENCY.	A laboratory such as the Underwriters' Laboratories, Inc., U.S. Bureau of Mines, Factory Mutual Laboratories or the American Gas Association Laboratories.

NFPA.	National Fire Protection Association 60 Batterymarch Street Boston 10, Mass. 02110
PLACE OF EMPLOYMENT.	Any building or other premises occupied by an employer in or about which an employee customarily is suffered or permitted to work.
PLENUM.	An air compartment or chamber to which one or more ducts are connected, and which forms part of an air supply or return system.
FURNACE SUPPLY PLENUM.	A furnace plenum attached directly to, or an integral part of, the supply outlet of the furnace.
FURNACE RETURN PLENUM	A furnace plenum attached directly to, or an integral part of, the return-air inlet of the furnace.
PRIMARY SAFETY CONTROL.	A control responsive directly to flame properties, sensing the presence of flame and in the event of ignition failure or unintentional flame extinguishment, causing safety shut down.
RESIDENTIAL TYPE APPLIANCE.	A fuel-burning or electric heating or cooking appliance not larger than 100 cubic feet in size (excluding any burner equipment and blower compartment) intended mainly for use in residences but which may be used also in other buildings. Such appliances include cooking stoves and ranges, clothes dryer, fireplace stoves, laundry stoves, room heaters, water heaters, heat pumps, floor furnaces, wall furnaces and central heating furnaces and boilers, except high pressure boilers.
RESTAURANT TYPE COOKING EQUIPMENT.	See 12.1.a.
ROOM HEATER, RESIDENTIAL TYPE.	See 6.1.a.
CIRCULATING TYPE ROOM HEATER.	See 6.1.b.
RADIANT TYPE ROOM HEATER.	See 6.1.c.
ROOMS LARGE IN COMPARISON WITH THE SIZE OF THE APPLIANCE.	Rooms having a volume equal to at least 12 times the total volume of the furnace and at least 16 times the total volume of the boiler. Total volume of furnace or boiler is determined

from exterior dimensions and is to include fan compartments and burner vestibules, when used. When the actual ceiling height of a room is greater than 8 feet, the volume of a room shall be figured on the basis of a ceiling height of 8 feet.

**SEALED COMBUSTION
SYSTEM APPLIANCE.**

A self-contained appliance which by its inherent design is constructed so that all air supplied for combustion, the combustion system of the appliance, and all products of combustion are completely isolated from the atmosphere of the space in which it is installed.

SHALL.

Indicates a mandatory requirement.

**UNFIRED PRESSURE
VESSEL.**

A closed metal vessel which contains air, steam, gas or liquid pressure in excess of 15 pounds per square inch gauge, which is supplied from an external source.

UNIT HEATER.

See 11.1.a.

**FLOOR MOUNTED UNIT
HEATER.**

See 11.1.d.

**STEAM OR HOT WATER
UNIT HEATER.**

See 11.1.b.

**SUSPENDED TYPE UNIT
HEATER.**

See 11.1.c.

**WALL FURNACE,
RESIDENTIAL TYPE.**

See 8.1.a.

WATER HEATER.

INDUSTRIAL TYPE.

See 10.1.a.

RESIDENTIAL TYPE.

See 7.1.a.

SECTION 3

RESIDENTIAL TYPE BOILERS

3.1. DEFINITION.

- a. Residential type boiler shall mean a boiler furnishing hot water at pressures not exceeding 160 psi and at temperatures not more than 250° F. or steam at pressures not more than 15 psi.

3.2 MOUNTING.

- a. Residential type boilers, except as provided in 3.2.b through 3.2.f shall be mounted on the ground, or on floors of fire-resistive construction with non-combustible 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. Residential type boilers that are listed specifically for installation on a floor constructed of combustible material may be mounted in accordance with the conditions of such listing.
- c. Residential type boilers of the water-base type may be mounted on floors other than as specified in 3.2.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 3.2.g.
- d. Residential type 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 3.2.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 1/4 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 3.3.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 3.2.g.

- e. Residential type boilers may be mounted on floors other than as specified in 3.2.g 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 joints 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 3.2.g.
- f. Residential type 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 3.2.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 steel plate not less than 3/16 of an inch thick. If solid fuel is used, see 3.2.g.
- g. In all cases where residential type boilers burning solid fuel are mounted on floors other than as specified in 3.2.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 1/4 of an inch thick covered with sheet metal of not less than 24 gauge, or with protection equivalent thereto.

3.3 CLEARANCES.

- a. Residential type boilers installed in rooms which are large in comparison with the size of the appliance, except as provided in 3.3.a.1, 3.3.a.2 and 3.3.a.3, shall be installed to provide clearances to combustible material not less than as shown in Table 3.3.a.
 - 1. Residential type boilers that have been tested by an approved testing agency and found to require clearances greater than specified in Table 3.3.a shall be installed with such clearances unless protected as specified in Table 3.3.b.
 - 2. Residential type boilers that are listed specifically for installation with clearances less than specified in Table 3.3.a may be installed in accordance with the conditions of such listing.
 - 3. Residential type boilers may be installed in rooms, but not in spaces such as alcoves or closets, with reduced clearances to combustible material provided the combustible material or the appliance is protected as described in Table 3.3.b.

Table 3.3.a. Clearances, Inches, for Residential Type Appliances

RESIDENTIAL TYPE APPLIANCES FOR INSTALLATION IN ROOMS WHICH ARE LARGE IN COMPARISON TO THE SIZE OF THE APPLIANCE.		APPLIANCE					
		Above Top of Casing or Appliance	From Top and Sides of Warm-Air Bonnet or Plenum	From Front	From Back	From Sides	Chimney or Vent Connector (1)
Boilers and Water Heaters							
Steam Boilers—15 psi	Automatic Oil						
Water Boilers—250°F	or	6	—	24	6	6	18
Water Heaters—200°F	Comb. Gas-Oil						
All Water Walled	Automatic Gas	6	—	18	6	6	9
or Jacketed	Solid	6	—	48	6	6	18
Furnaces—Central							
	Automatic Oil						
	or	6(2)	6(2)	24	6	6	18
Gravity, Upflow, Down-	Comb. Gas-Oil						
flow, Horizontal and	Automatic Gas	6(2)	6(2)	18	6	6	9
Duct. Warm-Air	Solid	18(3)	18(3)	48	18	18	18
250°F Max.	Electric	6(2)	6(2)	18	6	6	
Furnaces—Floor							
	Automatic Oil						
	or	36	—	12	12	12	18
For Mounting in	Comb. Gas-Oil						
Combustible Floors	Automatic Gas	36	—	12	12	12	9
Heat Exchanger							
Steam—15psi Max.	—	1	1	1	1	1	—
Hot Water—250°F Max.							
Room Heaters							
Circulating Type	Oil or Solid	36	—	24	12	12	18
Vented or Unvented	Gas	36	—	24	12	12	9
	Oil or Solid	36	—	36	36	36	18
	Gas	36	—	36	18	18	9
Radiant or Other Type	Gas with						
Vented or Unvented	double metal	36	—	36	12	18	9
	or ceramic						
	back						

Notes to Table

1. The minimum dimension should be 18 inches for gas appliances not equipped with draft hoods, except clothes dryers. The dimensions may be 6 inches for approved gas appliances equipped with draft hoods and for boilers and furnaces equipped with approved gas conversion burners and with draft hoods. A vent connector of approved Type B or L venting material may be used with approved gas appliances with draft hoods and may be installed at clearances marked on the material.

2. For a listed oil, combination gas-oil, gas or electric furnace this dimension may be 2 inches if the furnace limit control cannot be set higher than 250°F or this dimension may be 1 inch if the limit control cannot be set higher than 200°F .
3. The dimension may be 6 inches for an automatically stroker-fired forced warm-air furnace equipped with 250°F limit control and with barometric draft control operated by draft intensity and permanently set to limit draft to a maximum intensity of 0.13 inch water gauge.

- b. Residential type boilers shall not be installed in closed spaces such as alcoves or closets unless they have been listed specifically for such installation and are installed in accordance with the conditions of such listing. Installation clearances for residential type boilers that have been listed for closed spaces shall not be reduced by protection methods described in Table 3.3.b.

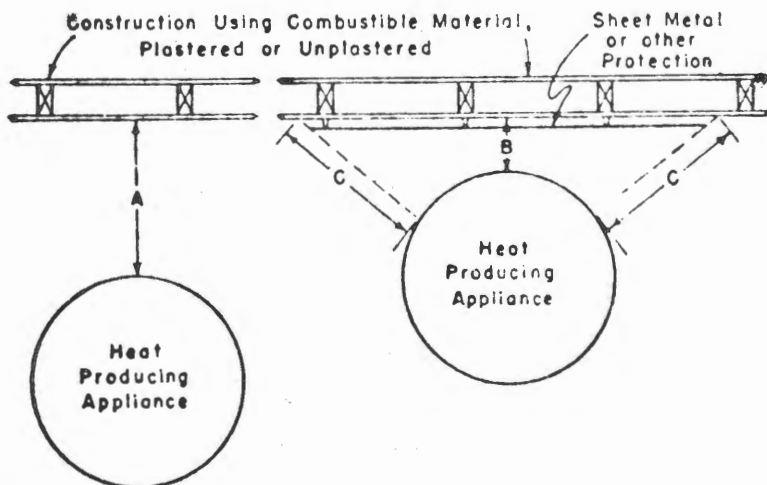


Figure 3.3. Extent of Protection Required to Reduce Clearances from Heating Appliances, Chimneys or Vent Connectors.

Notes To Figure

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

B equals the reduced clearance permitted in accordance with Table 3.3.b. The protection applied to the construction using combustible material shall extend far enough in each direction to make C equal to A.

Table 3.3.b

Clearances, Inches, With Specified Forms of Protection (1)

TYPE OF PROTECTION	WHERE THE REQUIRED CLEARANCE WITH NO PROTECTION IS:											
	36 INCHES			18 INCHES			12 INCHES		9 INCHES		6 INCHES	
	ABOVE	SIDES & REAR	CHIM- NEY OR VENT CON- NECTOR	ABOVE	SIDES & REAR	CHIM- NEY OR VENT CON- NECTOR	ABOVE	SIDES & REAR	CHIM- NEY OR VENT CON- NECTOR	ABOVE	SIDES & REAR	CHIM- NEY OR VENT CON- NECTOR
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. 3.3). Thicknesses are minimum.												
(a) ¼ in. asbestos millboard spaced out 1 in. (3)	30	18	30	15	9	12	9	6	6	3	2	3
(b) 28 gauge sheet metal on ¼ inc. asbestos millboard	24	18	24	12	9	12	9	6	4	3	2	2
(c) 28 gauge sheet metal spaced out 1 in. (3)	18	12	18	9	6	9	6	4	4	2	2	2
(d) 28 gauge sheet metal on 1/8 in. asbestos millboard spaced out 1 in. (3)	18	12	18	9	6	9	6	4	4	2	2	2
(e) 1½ in. asbestos cement covering on heating appliance (2)	18	12	36	9	6	18	6	4	9	2	1	6
(f) ¼ in. asbestos millboard on 1 in. mineral fiber batts 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. mineral fiber batts reinforced with wire or equivalent	18	12	12	4	3	3	2	2	2	2	2	2
(h) ¼ in. asbestos cement board of 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

Notes To Table

1. 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.
 2. The clearance shall be measured from the outer surface of the protective covering to the combustible material.
 3. Spacers shall be of noncombustible material.
-

3.4 CONTROLS.

- a. Temperature limit controls shall be of a listed type and shall be such that they cannot be set higher than the specified temperature setting.
- b. Steam and hot water boilers respectively shall be provided with approved automatic limiting devices to prevent boiler steam pressure or boiler water temperature from exceeding the maximum allowable working pressure or temperature.
- c. Steam boilers shall be provided with an automatic low water fuel cutoff to prevent firing the boiler in the event that the boiler water level drops to the lowest safe water line.
- d. Steam and hot water boilers shall be equipped respectively with approved steam safety or pressure relief valves of appropriate discharge capacity. Steam safety valves and pressure relief valves shall be set to discharge at a pressure not to exceed the maximum allowable working pressure of the boiler.

SECTION 4

RESIDENTIAL TYPE CENTRAL FURNACES

4.1 DEFINITIONS.

- a. Furnace, central, warm air, residential type shall mean a self contained indirect fired appliance designed to supply heated air through ducts to spaces remote from or adjacent to the appliance location.
 - 1. Forced air type furnace shall mean a central furnace equipped with a fan or blower which provides the primary means for circulation of air.
 - 2. Gravity type furnace shall mean a central furnace depending primarily on circulation of air by gravity.
- b. Furnace, downflow shall mean a forced air type central furnace designed with air flow through the furnace essentially in a vertical path, discharging air at or near the bottom of the furnace.
- c. Furnace, duct shall mean a central furnace designed for 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 part of the furnace.
- d. Furnace, horizontal shall mean a forced air type central furnace designed with air flow through the furnace essentially in a horizontal path.
- e. Furnace, upflow shall mean a central furnace designed with air flow through the furnace essentially in a vertical path, discharging air at or near the top of the furnace.

4.2 MOUNTING.

- a. Residential type central furnaces shall comply with the mounting provisions of 3.2 except as provided in 4.2.b and 4.2.c.
- b. Forced warm air furnaces may be mounted on floors other than as specified in 4.2.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.
- c. Downflow type central furnaces shall not be mounted on floors other than specified in 3.2.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. Downflow furnaces that are listed specifically for installation on a floor constructed of combustible material may be mounted in accordance with the conditions of such listing. Downflow furnaces shall be installed so that there are no open passages in the floor through which flame or hot gases from a fire originated in the space below the floor can travel to the room above.

4.3 CLEARANCES.

- a. Residential type central furnaces installed in rooms which are large in comparison with the size of the appliance, except as provided in 4.3.a.1, 4.3.a.2 and 4.3.a.3, shall be installed to provide clearances to combustible material not less than as shown in Table 3.3.a.
 1. Residential type central furnaces that have been tested by a nationally recognized testing agency and found to require clearances greater than specified in Table 3.3.a shall be installed with such clearances unless protected as specified in Table 3.3.b.
 2. Residential type central furnaces that are specifically for installation with clearances less than specified in Table 3.3.a may be installed in accordance with the conditions of such listing.
 3. Residential type central furnaces may be installed in rooms, but not in closed spaces such as alcoves or closets, with reduced clearances to combustible materials provided the combustible material or the appliance is protected as described in Table 3.3.b.
- b. Residential type central furnaces shall not be installed in closed spaces such as alcoves or closets unless they have been listed specifically for such installation and are installed in accordance with the conditions of such listing. Installation clearances for residential type central furnaces that have been listed for installation in closed spaces shall not be reduced by protection methods described in Table 3.3.b.
- c. Where the plenum is adjacent to plaster on metal lath or other combustible 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.

4.4 CONTROLS.

- a. Temperature limit controls shall be of a listed type and shall be such that they cannot be set higher than the specified temperature setting.

- b. 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 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.
- c. Controls for duct furnaces shall be located outside the duct except for the sensing element of a control.
- d. 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.
- e. 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 fire furnaces by 4.4.b.

4.5 ATTIC FURNACES.

- a. Furnaces shall not be installed in attics unless they are of a type listed specifically for such installation.

4.6 OUTDOOR INSTALLATIONS.

- a. Residential type central furnaces that have been tested by a nationally recognized testing agency for outdoor installation only shall not be installed inside of a building.

SECTION 5

RESIDENTIAL TYPE FLOOR FURNACES

5.1 DEFINITION.

- a. Floor furnace, residential type shall mean a self contained furnace designed to be suspended from the floor of the space being heated.

5.2 INSTALLATION.

- a. Floor furnaces shall not be installed in floors constructed of combustible material unless listed specifically for such installation and installed in accordance with the conditions of such listing.

5.3 SUPPORT.

- a. 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.

5.4 CLEARANCES.

- a. 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.

5.5 ACCESS.

- a. 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.

5.6 LOCATION OF THERMOSTAT.

- a. A thermostate 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.

5.7 UPPER FLOOR INSTALLATION.

- a. Floor furnaces shall not be installed in an upper floor of any building except that listed 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 resistance.

5.8 FIRST OR GROUND FLOOR INSTALLATION.

- a. Approved floor furnaces installed in the first or ground floor of buildings shall be enclosed as specified for upper floor installations and shall project into a nonhabitable space.

5.9 PLACEMENT.

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

SECTION 6

RESIDENTIAL TYPE ROOM HEATERS

6.1 DEFINITIONS.

- a. Room heater, residential type shall mean a self-contained free standing heating appliance which is intended solely to heat the space in which they are installed without the aid of distribution system and shall apply to the two types of room heaters defined in 6.1.b and 6.1.c as well as to other similar types when so classified by the Bureau.
- b. Room heater, circulating type shall mean a room heater with an outer jacket surrounding the heat exchanger and having openings at the top and bottom to permit air to circulate between the jacket and the exchanger.
- c. Room heater, radiant shall mean a room heater designed to transfer heat primarily by direct radiation and jacketed room heaters with openings in the jacket to permit some direct radiation.

6.2 MOUNTING.

- a. Residential type room heaters, except as provided in 6.2.b. through 6.2.e, shall be mounted on the ground or on floors of fire-resistive construction 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. Residential type room heaters that are listed specifically for installation on a floor constructed of combustible material may be mounted in accordance with the conditions of such listing.
- c. Residential type room heaters 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 6.2.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 listed for installation on a combustible floor.

- d. Residential type room heaters 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 within 18 inches of the floor, may be mounted on floors other than as specified in 6.2.a without special floor protection, provided there is at least one sheet metal baffle between the burners and the floor.
- e. Residential type room heaters may be mounted on the floors other than as specified in 6.2.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.

6.3 CLEARANCES.

- a. Residential type room heaters, except as provided in 6.3.b and 6.3.c, shall be installed to provide clearances to combustible material not less than as shown in Table 3.3.a.
- b. Residential type room heaters that are specifically listed for installation with lesser clearances than specified in 3.3.a may be installed in accordance with the conditions of such listing.
- c. Residential type room heaters may be installed in rooms, but not in closed spaces such as alcoves or closets, with reduced clearances to combustible material, provided the combustible material or the appliance is protected as described in Table 3.3.b.
- d. Liquid fuel burning, floor mounted residential type room heaters which have a fuel tank attached thereto shall in all cases be installed with sufficient clearances to provide direct and easy access to the fuel tank.

6.4 IN LIVING QUARTERS.

- a. Room heaters, except listed electric type, shall be of the vented type and shall be connected to an effective chimney or vent and equipped with an automatic pilot when installed in living quarters.

SECTION 7

RESIDENTIAL TYPE WATER HEATERS

7.1 DEFINITION.

- a. Water heater, residential type shall mean an appliance intended primarily for supplying hot water for purposes other than for building heating, or industrial heating appliances.

7.2 MOUNTING.

- a. Residential type water heaters shall be mounted as provided in 6.2.

7.3 CLEARANCES.

- a. Residential type water heaters shall have clearances as provided in 6.3.

7.4 CONTROLS.

- a. An automatic type water heater or a hot water storage vessel shall be installed with an automatic energy shutoff system, or a temperature relief valve, or a combination temperature and pressure relief valve.

SECTION 8

RESIDENTIAL TYPE WALL FURNACES

8.1 DEFINITION.

- a. Wall furnace, residential type shall mean a self-contained, vented appliance complete with grills or equivalent registers, designed for incorporation or attachment to the structure of the building and furnishing heated air circulated by gravity or by a fan directly into the space to be heated through grills in the casing, except they do not apply to floor furnaces, unit heaters and central furnaces.

8.2 INSTALLATION.

- a. Wall furnaces shall not be installed in or attached to walls, partitions, floors or ceilings constructed of combustible material unless listed specifically for such installation and installed in accordance with the conditions of such listing.
- b. Wall furnaces shall be so located as not to cause a fire hazard to walls, floors, curtains, furniture and doors. The face of a warm register shall be not less than 36 inches from any wall or combustible surface directly opposite the register. Wall furnaces installed between toilet rooms and adjoining rooms shall not circulate air from toilet rooms to other parts of the building.
- c. Panels, grilles and access doors which must be removed for normal servicing operations of wall furnaces shall not be attached to the building.
- d. Wall furnaces shall not be provided with duct extensions beyond the vertical and horizontal limits of the casing proper, except that boots not to exceed 10 inches beyond the horizontal limits of the casing for extension through walls of nominal thickness may be permitted. When such boots are provided, they shall be supplied by the manufacturer as an integral part of the appliance.

SECTION 9

AIR CONDITIONING APPLIANCES AND HEAT PUMPS

9.1 DEFINITIONS.

- a. Air conditioning appliance shall mean an appliance that treats air so as to control simultaneously its temperature, humidity, cleanness and distribution to meet the requirements of a conditioned space.
- b. Heat pump shall mean a refrigeration system arranged to accomplish either heating or cooling.

9.2 INSTALLATION.

- a. Air conditioning appliances shall be installed in accordance with 4.2 and 4.3 except as provided in 9.2.b through 9.2.d.
- b. Heat pumps shall not be installed in or attached to walls, partitions, floors or ceilings constructed of combustible material unless listed specifically for such installation and installed in accordance with the conditions of such listing.
- c. Equipment involving electric resistance heating shall not be installed in an attic or in a space in the building construction used as a supply or return plenum. Cooling units or heat pumps shall not be installed in such a supply or return plenum unless specifically listed for use. Such units or equipment shall be installed in accordance with the conditions of such listing. The use of attic or building construction space shall comply with 19.9.
- d. Heat pump systems involving units or equipment installed in attics or in a space in the building construction used as a supply or return plenum, shall conform to the appropriate provisions of 19.9.
- e. Central furnaces with cooling units (mechanical) that have been tested by an approved testing agency for outdoor installation only shall not be installed inside of a building.

9.3 REFRIGERATION COILS WITH CENTRAL FURNACES.

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

- b. Furnaces shall not be located upstream from cooling units unless the cooling unit is designed or equipped so as not to develop excessive temperature or pressure.
- c. Refrigeration coils shall be installed in parallel with or on the downstream side of central furnaces to avoid condensation in the heating element unless the furnace has been specifically listed for downstream installation. With a parallel flow arrangement, the dampers or other means used to control flow of air shall be sufficiently tight to prevent any circulation of cooled air through the furnace.
- d. Adequate means shall be provided for disposal of condensate and to prevent dripping of condensate on the heating element.

9.4 COOLING UNITS USED WITH HEATING BOILERS.

- a. Boilers, when used in conjunction with refrigeration system, shall be installed so that the chilled medium is piped in parallel with the heating boiler with appropriate valves to prevent the chilled medium from entering the heating boiler.
- b. When hot water heating boilers are connected to heating coils located in air handling units where they may be exposed to refrigerated air circulation, such boiler piping systems shall be equipped with flow control valves or other automatic means to prevent gravity circulation of the boiler water during the cooling cycle.

9.5 CONTROLS FOR HEAT PUMPS.

- a. Except as otherwise provided in 20.10, heat pump systems that are equipped with supplemental heating units shall be equipped with a temperature limit control located not more than 2 feet downstream from all heat input devices and of a type that will limit outlet air temperature to 200°F.

SECTION 10

INDUSTRIAL TYPE LOW HEAT APPLIANCES

10.1 DEFINITIONS.

- a. Low-heat industrial appliance shall mean an industrial appliance developing temperatures below 600°F in portions where substances or materials are heated, such as a building heating appliance for heating building spaces having a total volume exceeding 25,000 cubic feet except residential type appliances, a steam boiler operating at not over 50 pounds per square inch gauge pressure, commercial type clothes dryer, pressing machine boiler at any pressure, bake oven, candy furnace, stereotype furnace, and drying and curing appliance. Appliances otherwise classed as medium-heat appliances are considered as low-heat appliances if not larger than 100 cubic feet in size.
- b. Commercial type clothes dryer shall mean an appliance used to dry wet laundry by means of heat and designed for use in business but may or may not be operated by the public.

10.2 MOUNTING.

- a. Except as provided in 10.2.b through 10.2.e, low heat appliances shall be mounted on the ground, or on floors of fire-resistive construction with non-combustible 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 shall extend not less than 8 inches at any side where ashes or hot products are removed.
- b. Low heat appliances which are listed specifically for installation on a floor constructed of combustible material may be mounted in accordance with the conditions of such listing.
- 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 10.2.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, see 10.2.f.

- 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 10.2.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 to provide a free circulation of air from the side through the masonry. Where solid fuel is used, see 10.2.f.
- e. Low heat appliances may be mounted on floors other than as specified in 10.2.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, see 10.2.f.
- f. In all cases where low-heat industrial appliances burning solid fuel are mounted on floors other than as specified in 10.2.a, 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 1/4 of an inch thick covered with sheet metal not less than 24 gauge, or with protection equivalent thereto.

10.3 CLEARANCES.

- a. Except as provided in 10.3.b and 10.3.c, low heat appliances shall be installed to provide a clearance to combustible material, of not less than shown in Table 10.3.a, except 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 listed specifically for installation with lesser clearances than specified in 10.3.a, may be installed in accordance with the conditions of such listing.
- c. Low heat appliances may be installed with reduced clearances to combustible material, provided the combustible material or the appliance is protected as described in Table 3.3.b.

Table 10,3.a. Clearances, Inches, for Industrial Type Low-Heat Appliances

INDUSTRIAL TYPE LOW-HEAT APPLIANCES		APPLIANCE					
		ABOVE TOP OF CASING OR APPLIANCE (2)	FROM TOP AND SIDES OF WARM-AIR BONNET OR PLENUM	FROM FRONT	FROM BACK (2)	FROM SIDES (2)	CHIMNEY OR VENT CONNECTOR (1)
ANY AND ALL PHYSICAL SIZES EXCEPT AS NOTED							
Boilers and Water Heaters							
100 cu. ft or less							
Any psi Steam	All Fuels	18	—	48	18	18	18
50 psi or less							
Any Size	All Fuels	18	—	48	18	18	18
Unit Heaters							
Floor Mounted or	Steam or						
Suspended—Any Size	Hot Water	1	—	—	1	1	—
Suspended—	Oil or						
100 cu ft or less	Comb. Gas-Oil	6	—	24	18	18	18
Suspended—							
100 cu ft or less	Gas	6	—	18	18	18	9
Suspended—							
Over 100 cu ft	All Fuels	18	—	48	18	18	18
Floor Mounted							
Any Size	All Fuels	18	—	48	18	18	18
Ranges—Restaurant Type							
Floor Mounted	All Fuels	48	—	48	18	18	18
Other Low-Heat Industrial Appliances							
Floor Mounted or							
Suspended	All Fuels	18	18	48	18	18	18

Notes to Table

1. The minimum dimension should be 18 in. for gas appliances not equipped with draft hoods, except clothes dryers. The dimension may be 6 inches for approved gas appliances equipped with draft hoods and for boilers and furnaces equipped with approved gas conversion burners and with draft hoods. A vent control of approved Type B or L venting material may be used with approved gas appliances with draft hoods and may be installed at clearances marked on the material.
2. If the appliance is encased in brick, the 18 inches clearance above and at sides and rear may be reduced to not less than 12 inches.

SECTION 11

UNIT HEATERS.

11.1 DEFINITIONS.

- a. Unit heater shall mean a self-contained, automatically controlled heating appliance, intended for installation within and heating of non-residential spaces and which is equipped with integral means for circulating air.
- b. Steam or hot water unit heater shall mean a unit heater which uses steam or hot water as a medium for transmitting heat to the air.
- c. Suspended type unit heater shall mean a unit heater which is suspended from the ceiling or roof structure, or supported between uprights or on wall or column brackets.
- d. Floor mounted unit heater shall mean a unit heater which is mounted on the floor of the space to be heated.

11.2 FLOOR MOUNTED UNIT HEATERS.

- a. Floor mounted unit heaters shall be installed as provided in 3.2.

11.3 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 unit heaters, except as provided in 11.3.d and 11.3.e, shall be installed to provide a clearance in any direction to combustible material of not less than as shown in Table 10.3.a.
- c. Suspended type unit heaters that are listed specifically for installation with lesser clearances than specified in 11.3.b. may be installed in accordance with the conditions of such listing.
- d. Suspended type unit heaters and their connectors may be installed with lesser clearances to combustible material, provided the combustible material is protected as described in Table 3.3.b.

- e. Suspended type unit heaters shall not be attached to a warm air duct system unless listed specifically for such installation and installed in accordance with the conditions of such listing.

11.4 STEAM OR HOT WATER UNIT HEATERS.

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

SECTION 12

RESTAURANT TYPE COOKING EQUIPMENT

12.1 DEFINITION.

- a. Restaurant type cooking equipment shall include ranges, ovens, boilers, and other miscellaneous cooking appliances, of the types designed for use in restaurant and commercial kitchens.

12.2 MOUNTING OF FLOOR TYPE RESTAURANT TYPE EQUIPMENT.

- a. Floor mounted restaurant type cooking equipment, except as provided in 12.2.b, through 12.2.g, 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.
- b. Floor mounted restaurant type cooling equipment that is listed specifically for installation on a floor constructed of combustible material may be mounted in accordance with the conditions of such listing.
- c. Gas burning floor mounted restaurant type cooking equipment that is designed and marked "For use only in fire-resistive locations" shall be mounted only in accordance with 12.2.a.
- d. Floor mounted restaurant type cooking equipment which is set on legs that provide not less than 18 inches open space under the base of the appliance, or which has 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 12.2.a, provided there is at least one sheet metal baffle between the burners and the floor. If solid fuel is used, see 12.2.h.
- e. Floor mounted restaurant type cooking equipment which is 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 12.2.a, provided the floor under the appliance is protected with asbestos millboard not less than 3/8 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. If solid fuel is used, see 12.2.h.

- f. Floor mounted restaurant type cooking equipment which is 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 12.2.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. If solid fuel is used, see 12.2.h.
- g. Floor mounted restaurant type cooking equipment may be mounted on floors other than as specified in 12.2.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. If solid fuel is used, see 12.2.h.
- h. In all cases where restaurant type cooking equipment burning solid fuel is mounted on floors other than specified in 12.2.a, the floor for not less than 18 inches beyond the front of the appliance on the side where ashes are removed shall be protected with asbestos millboard not less than 1/4 of an inch thick covered with sheet metal not less than 24 gauge, or with protection equivalent thereto.

12.3 CLEARANCES OF FLOOR-MOUNTED RESTAURANT TYPE COOKING EQUIPMENT.

- a. Floor mounted restaurant type cooking equipment, except as provided in 12.3.b through 12.3.e, shall be installed to provide a clearance to combustible material of not less than shown in Table 11.3.a.
- b. Floor mounted restaurant type cooking equipment that is listed specifically for installation with lesser clearances than specified in 11.3.a, may be installed in accordance with the conditions of such listing.
- c. Gas burning, floor mounted restaurant type cooking equipment that is designed and marked "For use only in fire-resistive locations" shall not be installed elsewhere.
- d. Floor mounted restaurant type cooking equipment may be installed in rooms, but not in spaces such as alcoves or closets, with reduced clearances to combustible material, provided the combustible material or the appliance is protected as described in Table 3.3.b.
- e. 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 item (c) of Table 3.3.b 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.

12.4 VENTILATION OF RESTAURANT TYPE COOKING EQUIPMENT.

- a. Restaurant type cooking equipment shall be ventilated in accordance with Chapter 122, Local Exhaust Systems of Title 12, N.J.A.C.

SECTION 13

INDUSTRIAL TYPE MEDIUM-HEAT APPLIANCES

13.1 DEFINITION.

- a. Industrial type medium-heat appliance shall mean an appliance developing temperatures between 600°F. and 1500°F. in portions where substances or materials are heated, such as annealing furnace (glass or metal), charcoal furnace, galvanizing furnace, gas producer, and steam boiler operating at over 50 pounds per square inch gauge pressure. An appliance otherwise classed as a high heat appliance may be considered as a medium-heat appliance if not larger than 100 cubic feet in size.

13.2 MOUNTING.

- a. Except as provided in 13.2.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. Such construction shall extend not less than 3 feet beyond the appliance on all sides, and shall extend not less than 8 feet at any side where ashes or hot products 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 13.2.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.

13.3 CLEARANCES.

- a. Medium heat appliances shall be installed to provide a combustible material of not less than shown in Table 13.3.a, except 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.

13.4 VENTILATION.

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

Table 13.3.a. Clearances, Inches, for Industrial Type Medium-Heat Appliances

INDUSTRIAL TYPE MEDIUM-HEAT APPLIANCES		APPLIANCE					
		ABOVE TOP OF CASING OR APPLIANCE (1)	FROM TOP AND SIDES OF WARM-AIR BONNET OR PLENUM	FROM FRONT	FROM BACK (1)	FROM SIDES (1)	CHIMNEY CON- NECTOR
Boilers and Water Heaters							
Over 50 psi	All Fuels	48	—	96	36	36	36
Over 100 cu ft							
Other Med-Heat Industrial							
Appliances	All Fuels	48	36	96	36	36	36
All Sizes							
Incinerators							
All Sizes	—	48	—	96	36	36	36

Note To Table

1. If the appliance is encased in brick, the clearance above and at sides and rear may be reduced to not less than 12 inches.

SECTION 14

INDUSTRIAL TYPE HIGH HEAT APPLIANCES

14.1 DEFINITION.

- a. Industrial type high-heat appliance shall include appliances developing temperatures above 1500°F in portions where substances or materials are heated, such as billet and bloom furnace, blast furnace, brass melter, cupola, glass furnace, open-hearth furnace, and ceramic kiln and vitreous enameling oven (ferrous metals) when such appliances are larger than 100 cubic feet in size.

14.2 MOUNTING.

- a. Industrial type 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 in all cases extend not less than 10 feet beyond the appliance on all sides and shall extend not less than 30 feet at the front or side where hot products are removed.

14.3 CLEARANCES.

- a. Industrial type high heat appliances shall be installed to provide a clearance to 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 any side where ashes or hot products are removed.

14.4 VENTILATION.

- a. Rooms containing industrial type high heat appliances shall be provided with means of ventilation adequate to prevent accumulation of hot air over or near the appliance.

SECTION 15

DIRECT GAS FIRED MAKEUP AIR HEATERS

15.1 DEFINITION.

- a. Direct gas fired makeup air heater shall mean an appliance in which the combustion products of the flue gases are mixed with the medium (i.e. air) being heated.

15.2 USE.

- a. Direct gas-fired makeup air heaters shall be permitted to be installed in industrial spaces, commercial kitchens, garages, aircraft hangers, laundromats, and dry cleaning plants using non-flammable solvents.

15.3 DESIGN.

- a. The capacity of the heaters shall not exceed 110 per cent of the air exhausted by a matching exhaust system.
- b. Continuous full flow of outside air shall be provided without the recirculation of any heated air.
- c. A high rate of dilution of the products of combustion shall be provided so that the carbon monoxide, carbon dioxide or other noxious gases in the heated makeup air stream do not exceed the threshold limits set forth in Chapter 131, Threshold Limit Values of Title 12, N.J.A.C.
- d. The ratio of gas input to the total quantity of the mixture of combustion gases and air discharged by the equipment shall not exceed 0.2 per cent.

15.4 CONTROLS.

- a. The heater shall be equipped with a suitable primary safety control.
- b. Where an automatically operated air control is provided, the arrangement shall be such that in case of failure, safe combustion shall be obtained or the fuel shall be shut off within a safe period of time.
- c. A heater equipped with a forced or induced draft fan, or both, shall be arranged to assure safe combustion or to shut off the fuel supply within a safe period of time upon failure of the air supply.

- d. A heater employing air for combustion supplied by a source from which the flow may be interrupted without shutting off the fuel supply, shall be arranged to assure safe combustion during interruption and upon restoration of the air supply or to shut off the fuel upon failure of the air supply.
- e. A heater shall be provided with an integral limit control to prevent excessive temperature.

15.5 INSTALLATION.

- a. The discharge from the heater shall be supplied directly or indirectly to the space from which inside air is being exhausted.
- b. Listed heaters shall be provided with clearances to combustible material as provided in their listing.
- c. Unlisted heaters shall be installed with clearances acceptable to the Bureau.

SECTION 16

INFRA-RED RADIANT HEATERS

16.1 DEFINITION.

- a. Infra-red radiant gas fired heater shall mean a heater which directs a substantial amount of its energy output in the form of infra-red radiant energy in the area being heated. Such heaters may be of either the vented or unvented type.

16.2 DESIGN.

- a. Unvented gas-fired radiant heaters shall be listed or shall be constructed in accordance with the Approval Requirements for Unvented Infrared Radiant Heaters, ANSI Z21.43-1963.
- b. Vented gas-fired radiant heaters shall be listed or shall be constructed in accordance with the Approval Requirements for Vented Gas Fired Infrared Radiant Heaters, ANSI Z21.51-1967.

16.3 COMBUSTION AND VENTILATION AIR.

- a. Air for combustion for gas fired infra-red radiant heaters shall be provided by positive permanently opened vents having an area complying with 1.6. When there is danger of condensation due to high water vapor content of the interior atmosphere means shall be provided to raise the dew point of the roof or exterior wall construction by providing insulation or additional means of venting the water vapor to the outside.

16.4 INSTALLATION.

- a. Suspended type infra red radiant heaters shall be safely and adequately fixed in position independent of gas and electric supply lines. Hangers and brackets shall be of noncombustible material.
- b. Listed heaters shall be installed with clearances from combustible material of not less than that shown on the marking plate and in the manufacturer's instructions. Unlisted heaters shall be installed with clearances acceptable to the Bureau.
- c. The volume of the space in which unvented infra red gas-fired radiant heaters are installed shall not be less than one cubic foot per 30 Btu per hour of the aggregate input rating of the unvented gas-fired equipment installed.

SECTION 17

INCINERATORS

17.1 DEFINITION.

- a. Any device, apparatus, equipment or structure used for destroying, reducing or salvaging by fire any material or substance including but not limited to refuse, rubbish, garbage, trade waste, debris or scrap or a facility for cremating human or animal remains.

17.2 PERFORMANCE.

- a. Incinerators shall be designed to burn the particular type of combination of types of wastes it is to receive.
- b. Waste shall be classified according to type as provided in Table 17.2.b.
- c. The installation of equipment for the reduction of refuse by means other than permitted by this Section 17 may be used when approved by the Bureau when equivalent performance is provided, and compliance with all requirements of the New Jersey Air Pollution Control Code has been demonstrated.

17.3 AUXILIARY BURNERS.

- a. Incinerators burning waste other than trash which require auxiliary heat to provide maximum combustion shall be provided with auxiliary burners.
- b. When waste having a moisture content in excess of 25 percent is burned in an incinerator it shall be equipped with an auxiliary burner providing the recommended minimum Btus per hour pound of waste as provided in Table 17.2.b. When different types of waste are burned separately or in combination with one another the burner capacity shall equal that required for the waste having the highest moisture content.
- c. All auxiliary burners shall be installed in compliance with accepted engineering practice for heat producing appliances as provided in 1.12.
- d. 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 gas at the main burner shall be equipped with a device which will automatically shut off the main gas supply in the event the

Table 17.2.b
Classification of Wastes to be Incinerated

CLASSIFICATION OF WASTES TYPE DESCRIPTION	PRINCIPAL COMPONENTS	APPROXIMATE COMPOSITION % BY WEIGHT	MOISTURE CONTENT %
0 Trash (1)	Highly combustible waste, paper, wood cardboard cartons, including up to 10% treated papers, plastic or rubber scraps; commercial and industrial sources	Trash 100%	10%
1 Rubbish (1)	Combustible waste, paper, cartons, rags, wood scraps, combustible floor sweepings; domestic, commercial, and industrial sources	Rubbish 80% Garbage 20%	25%
2 Refuse (1)	Rubbish and garbage; residential sources	Rubbish 50% Garbage 50%	50%
3 Garbage (1)	Animal and vegetable wastes, restaurants, hotels, markets; institutional, commercial and club sources	Garbage 65% Rubbish 35%	70%
4 Animal solids and organic wastes	Carcasses, organs, solid organic wastes; hospital, laboratory, abattoirs, animal pounds, and similar sources	100% Animal and Human Tissue	85%
5 Gaseous, liquid or semi-liquid wastes	Industrial process wastes	Variable	Dependent on pre-dominant components
6 Semi-solid and solid wastes	Combustibles requiring hearth, retort, or grate burning equipment	Variable	Dependent on pre-dominant components

Note To Table

1. The figures on moisture content, ash, and Btu as fired have been determined by analysis of many samples. They are recommended for use in computing heat

INCOMBUSTIBLE SOLIDS %	B.T.U. VALUE/LB. OF REFUSE AS FIRED	B.T.U. OF AUX. FUEL PER LB. OF WASTE TO BE INCLUDED IN COMBUSTION CALCULATIONS	RECOMMENDED MIN. B.T.U./HR. BURNER INPUT PER LB. WASTE
5%	8500	0	0
10%	6500	0	0
7%	4300	0	1500
5%	2500	1500	3000
5%	1000	3000	8000 (5000 Primary) (3000 Secondary)
Variable according to wastes survey	Variable according to wastes survey	Variable according to wastes survey	Variable according to wastes survey
Variable according to wastes survey	Variable according to wastes survey	Variable according to wastes survey	Variable according to wastes survey

release, burning rate, velocity, and other details of incinerator designs. Any design based on these calculations can accommodate minor variations.

means of ignition 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. The pilot burner shall be so located as to insure ignition of the main burner. It shall be connected to the gas supply line ahead of all controls except gas pressure regulators.

- e. Other methods of aiding combustion shall use acceptable engineering practice to assure adequate fire safety.

17.4 COMBUSTION CHAMBERS.

- a. Incinerators shall be designed with multiple chambers to provide adequate combustion so as to comply with the emission standards contained within the New Jersey Air Pollution Control Code, except that other designs which provide equivalent combustion and meet the emission standards may be approved by the Bureau.
- b. All incinerators shall be of heavy duty construction consisting of refractory walls, and of either steel casings with high temperature block insulation or brick masonry casings. They shall be designed to have multiple chambers consisting of primary, secondary and mixing chambers.
- c. Refractory walls, roof, bridge wall and curtain walls or baffles shall have the thickness of firebrick for the type of waste and capacity of incinerator as required by Table 17.4.c.
- d. The exterior casing shall be either not less than No. 12 U.S. gauge steel with not less than the thickness of high temperature block insulation required by Table 17.4.c or it may be 8 inches of brick masonry laid in cement mortar.
- e. There shall be a minimum 1 inch separation between the refractory lining and the exterior casing assembly.
- f. The steel casing or the exterior brick work, as the case may be, shall be reinforced to withstand interior thrusts from arches and to support all doors, burners and appurtenant assemblies. No metal stays, lintels or other supports shall be exposed to the interior of the combustion chambers.

17.5 MOUNTING.

- a. Incinerators shall be mounted on the floors of fire-resistive construction with noncombustible flooring or finish and with no combustible material or construction against the underside thereof. They shall extend at least 30 feet in front where hot products are removed and at least 10 feet on all other sides.

Table 17.4.c

WASTE TYPE No.	INCINERATOR CAPACITY	REFRACTORY LINING THICKNESS (1) Inches	BLOCK INSULATION THICKNESS Inches
1 or 2	Burning Area 25 Sq. Ft. or less	4-½	2
	Over 25 Sq. Ft.	9	2-½
0, 1, 2 or 3	500 lbs. or less per hour	4-½	2
	More than 500 lbs. per hour	9	2-½
4	150 lbs. or less per hour	4-½	2
	More than 500 lbs. per hour	9	2-½

Note to Table

1. Refractory lining shall be high heat duty firebrick having a PCE of not less than 31 and shall be laid in air setting high temperature cement.

17.6 CLEARANCES.

- a. Incinerators shall be classified as high-heat appliances except that when combined combustion chamber volume does not exceed 100 cubic feet they shall be considered as a medium-heat appliance.
- b. In lieu of test data substantiating lesser clearances to combustible construction, the clearances provided in Table 17.6.b shall be provided.
- c. The clearance from steel or brick casings of incinerators to noncombustible construction shall be not less than one inch.

17.7 INCINERATOR ROOMS.

- a. Incinerators shall be enclosed as required in 1.10 for medium or high heat appliances.
- b. Waste and waste containers and other building heating appliances may be enclosed in the same enclosure when the waste, if it has less than 25 percent

moisture content is protected by an automatic sprinkler system and a short length of hand hose connected to a suitable water supply.

- c. Air for combustion shall be supplied directly by screened or louvered ventilator openings or other suitable air intakes from the outside having an area not less than 0.5 square feet per million Btu's of the hourly waste capacity.

Table 17.6.b

DISTANCE TO COMBUSTIBLE CONSTRUCTION	FROM STEEL CASING Inches	FROM BRICK CASING Inches
Top	48	36
Sides and Rear	36	18
Front (or loading side or top)	96	96

17.8 REFUSE CHUTES, TERMINAL ROOMS OR BINS.

- a. Flue-fed incinerators shall not be permitted, except that in multi-family residential occupancies only, a single stack which extends 2 or more stories above the incinerator and which is separated into a refuse charging chute and a flue, may be permitted.
- b. 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.
- c. Rubbish or refuse chutes shall terminate or discharge directly into a room or bin except as provided for multifamily residential occupancies in which case they may discharge directly into the side of the combustion chamber when the discharge is controlled by a gate. Refuse rooms or bins shall be 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 except from incinerator rooms shall be protected by approved self-closing or automatic fire doors suitable for Class B situations.

- d. The daylight area of each service opening shall be limited to one-third of the cross-sectional area of the flue. No service opening shall be used that has an area in excess of 160 square inches.
- e. All service openings into refuse chute 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 chute and that the opening to the chute 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.
- f. No service opening shall be installed in any part of the combustion zone of an incinerator.
- g. Where the combustion chamber of an incinerator is charged through the floor above such incinerator, the charging chute shall not 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 resulting 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.
- h. 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 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 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.

17.9 CHIMNEY CONNECTORS.

- a. The chimney connectors or breechings connecting incinerators to chimneys or flues, except as provided in 17.9.b, shall be constructed of not lighter than 16 gauge steel when they are 12 inches or less in diameter or greatest di-

mension 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 fire brick not less than 4½ inches thick when they are over 18 inches in diameter or greatest dimension.

- b. Chimney connectors of incinerators specially constructed to produce low flue gas temperatures, and incinerator chimney connectors 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 chimney connectors or breechings lead into and combine with chimney connectors or breechings of other appliances, such other chimney connectors shall also be lined from this point to the chimney as specified in 17.9.a for incinerator flue connections, except that lining of this portion may be omitted where the cross-sectional area of such other chimney connector is at least equal to the area of the incinerator chimney connector 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 chimney connectors or breechings and combustible construction, including plastered constructions having combustible supports, shall be not less than 36 inches.

17.10 CHIMNEYS.

- a. All chimneys for incinerators shall comply with 1.11.1.a except that the termination (height) shall be not less than 10 feet higher than any portion of any building within 25 feet for medium-heat incinerators and not less than 20 feet higher than any portion of any building within 50 feet for high heat incinerators.

SECTION 18

STEAM AND HOT WATER PIPES

18.1 APPLICATION.

- a. This section shall apply to steam and hot water pipes used to distribute steam and hot water for heating purposes.

18.2 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 18.2.b and 18.2.c
- 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 $\frac{1}{2}$ 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.

18.3 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 $\frac{1}{4}$ of an inch thick.
- c. Coverings or insulation used on steam or hot water pipes shall be of non-combustible 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.

18.4 ANTIFREEZE SOLUTIONS FOR RADIANT HEATING COILS.

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

SECTION 19

RESIDENTIAL TYPE WARM AIR HEATING AND AIR CONDITIONING SYSTEMS

19.1 APPLICATION.

- a. This section shall apply to residential type central warm air heating and cooling systems including separate air cooling systems and combinations heating and air conditioning systems in commercial and industrial occupancies not exceeding 25,000 cubic feet.

19.2 DEFINITIONS.

- a. Air duct, Class 1 shall mean an air duct having a flame spread rating of not over 25 without evidence of continued progressive combustion and a smoke-developed rating of not over 50. The duct shall retard the passage of flame (fire) for a period of at least 30 minutes.
- b. Air duct, Class 2 shall mean an air duct having a flame spread rating of not over 50 without evidence of continued progressive combustion and a smoke-developed rating of not over 50 for the inside surface material and not over 100 for the outside surface material. The duct shall retard the passage of flame (fire) for a period of at least 15 minutes.

19.3 SUPPLY SYSTEMS-CONSTRUCTION.

- a. **Material.** Except as permitted by 19.3.b through 19.3.d supply systems shall be constructed entirely of sheet metal having a nominal thickness as shown in Table 19.3.a.

Table 19.3.a

DIAM. OR WIDTH Inches	NOMINAL THICKNESS Inches	EQUIVALENT GALVANIZED SHEET Gauge No.	APPROX. ALUMINUM B. & S. Gauge	MIN. WT. TIN-PLATE Lbs. per base box
Round ducts and enclosed Rectangular Ducts:				
14 or less	0.016	30	26	135
Over 14	0.019	28	24	-
Exposed Rectangular Ducts:				
14 or less	0.019	28	24	-
Over 14	0.022	26	23	-

- b. Supply ducts that are completely encased in not less than 2 inches of concrete in a floor slab need not meet the requirements of 19.3.a except within 2 feet of the furnace supply plenum, and within 2 feet of a vertical connection to a riser or register.
- c. Supply ducts serving occupancies having a volume of less than 25,000 cubic feet having central furnaces conforming to Note 2 of Table 3.3.a. or heat exchangers as in Table 3.3.a need not meet the requirements of 19.3.a, provided they are approved air ducts with the following limitations:
 - 1. Class 1 duct shall be used within 3 feet of approved furnaces and within 6 feet of other furnaces conforming to Note 2 of Table 3.3.a.
 - 2. Beyond those distances they shall be Class 1 or 2 air ducts.
- d. Supply systems for a separate air cooling system, not interconnected to any warm air heating system, serving occupancies having a volume of less than 25,000 cubic feet need not meet the requirements of 19.3.a, provided that they are not closer than 2 feet to any furnace or its supply plenum, boiler or other heat producing appliance, and that they comply with 19.10.a.1, 19.10.a.3, 19.10.b, and 19.10.c as specified for return ducts.
- e. 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 fabric shall not exceed 10 inches in length.
- f. Joints and seams 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 but where exposed to the air in the system, shall be not more combustible than approved flameproofed fabric.
- g. 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.
- h. 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.
- i. 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 $\frac{1}{4}$ of an inch thick or other equivalent fire-resistant insulation.

j. Registers for ducts.

1. Floor registers and fittings connecting the registers to the duct system shall be constructed of metal. Other types of registers shall be constructed of metal or material which complies with requirements of Class 2 air ducts.
2. Warm air furnace systems other than systems which are automatically fired with oil, gas or electricity, and have listed temperature limit controls, shall have at least one register or grill without closeable shutter, and the duct leading thereto shall be without a damper, except where dampers and shutters cannot shut off more than 80 percent of the duct area.

19.4 CLEARANCES FROM HORIZONTAL SUPPLY DUCTS.

- a. Where ducts are adjacent to plaster on metal lath or to other non-combustible finish attached to a combustible material, the clearance shall be measured to the combustible material, except that the clearance shall be measured to the surface of the plaster or other noncombustible finish where a clearance of 2 inches or less is specified above a bonnet or plenum chamber and above supply ducts. This shall not be construed to prohibit closure of openings with noncombustible material where ducts pass through walls and partitions, as provided in 19.4.b.5.
- b. Minimum clearances from horizontal supply ducts shall be as follows:
 1. Within a distance of 3 feet of a plenum of a system conforming to Note 2 of Table 3.3.a or heat exchangers as in Table 3.3.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 as a gas, liquid or electric central furnace not conforming to Note 2 or a solid fuel central furnace conforming to Note 3 of Table 3.3.a, the clearance shall be not less than 6 inches. From ducts of solid fuel central furnaces conforming to Note 3 of Table 3.3.a, the clearance shall be not less than one inch beyond 6 feet from the plenum to a point where there is a change in direction equivalent to 90 degrees or more.
 3. From ducts of furnaces other than as covered in Table 3.3.a, the clearance shall be not less than 18 inches out to 3 feet from the bonnet or plenum, not less than 6 inches from 3 feet to 6 feet, and not less than one inch beyond 6 feet.
 4. Beyond the distance from the plenum or change in direction specified in 19.4.b.1 and 19.4.b.2, no clearance is required.

5. Where a horizontal supply duct passes through or pierces a partition or enclosure constructed of combustible material within the distances or point of change in direction specified in 19.4.b.1, 19.4.b.2 and 19.4.b.3, the clearance shall be not less than that specified in those sections. 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 or metal lath.
6. Separate air cooling system ducts that are made of other than noncombustible material shall be installed with clearances to warm air ducts as required in 19.4.b.1, 19.4.b.2 and 19.4.b.3.

19.5 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 19.4.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, 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 19.6.
- 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 construction, 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 1/8 inch thick is provided (in metal lath and plaster partitions no air space is needed except from wood studs); or
 - 2. 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.

19.6 PIPELESS FURNACE REGISTERS.

- a. 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 cold air passage.

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

- a. Heating panels shall be used only with:
 - 1. Automatically fired gas or oil burning or automatic electric forced warm systems equipped with temperature limit controls that cannot be set above 200°F.; or
 - 2. 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. Heating panels shall be connected to supply ducts conforming to 19.3 and return air ducts conforming to 19.10.
- 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. This enclosing material shall be securely attached to the building structure; joints and

seams shall be substantially air tight. Braces and hangers inside the chambers shall be noncombustible.

2. Where warm air supply is from steam or hot water heat exchanger, heating panels shall either comply with 19.7.c.1, or shall be enclosed on all sides with material no cross section of which has a flame spread rating of over 200. 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.

19.8 USE OF UNDER FLOOR SPACE AS SUPPLY PLENUM. When heated air is discharged downward into an air chamber which forms a plenum of an under floor space, the following shall apply:

- a. Use of such spaces shall be restricted to one story portions of occupancies having a volume of less than 25,000 cubic feet.
- b. The enclosing material of the under floor space including the side wall insulation shall be such that no cross section has a flame spread rating of over 200. Combustible ground cover shall be covered with at least 2 inches of sand or other noncombustible material.
- c. The furnace supplying warm air to such space shall be equipped with an automatic control that will start the air circulating fan when the air in the furnace bonnet reaches a temperature not higher than 150°F. Such control shall be one that cannot be set higher than 150°F.
- d. The furnace supplying warm air to such space shall be equipped with an approved temperature limit control that will limit outlet air temperature to 200°F.
- e. Exterior walls and interior stud partitions shall be firestopped at the floor.
- f. Each wall register shall be connected to the air chamber with a duct or boot complying with 19.3.a, 17.5.a, and 17.5.b.
- g. Supply ducts to the air chamber shall comply with 17.3.a and 19.4.b, and shall terminate approximately under the center of a room above, at a distance of not less than 6 feet from the plenum chamber.
- h. Furnaces, boilers or other heat-producing appliances shall not be installed in such a supply plenum.

19.9 USE OF CONCEALED CEILING SPACES AS SUPPLY OR RETURN PLENUMS.

When concealed ceiling spaces are to be used for air chambers or plenums, the following shall apply:

- a. Such installations shall be limited to detached structures having a volume not over 25,000 cubic feet, and no concealed ceiling space plenum shall serve more than one story of such structure. This shall not preclude separate installations on each floor.
- b. The concealed space plenum shall be separated from any other concealed spaces and shall be completely enclosed with material no cross section of which has a flame spread rating of over 200.
- c. No ventilating system shall discharge into such spaces.
- d. Units supplying such spaces shall be designed to limit the temperature of the air discharged into the supply plenum or chamber to 165°F.
- e. Where units incorporate heating elements, heated surfaces, or combustion chambers, developing temperatures higher than 165°F., such components shall be shielded so as to prevent direct radiation onto combustible material when the unit is installed.
- f. Any duct used to convey heated air to or from the air chamber or plenum to distant rooms shall conform to 19.3 and 19.4.
- g. The installation of the unit supplying such spaces shall not produce negative pressure in the attic when the attic is the source of air for combustion for fuel fired equipment.

19.10 RETURN DUCTS.

a. Duct Material:

1. Return ducts, except as required by 19.10.a.2, may be constructed of metal, or of material no cross section of which has a flame spread rating of over 200.
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 19.3, for supply ducts.
3. The interior of combustible ducts shall be lined with sheet metal, asbestos cement board or other similar 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.
4. Floor registers shall be constructed of metal.

b. Firestopping:

1. Where return ducts are installed in walls, floors or partitions, their installation shall comply with the provisions of 19.3.
 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. 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 appliance through continuous ducts, except as indicated in 19.10.d.2 and 19.10.d.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 tightly and substantially enclosed. Furnaces, boilers or other heat producing appliances shall not be installed in such a return plenum.
 3. In a single story structure having a volume of less than 25,000 cubic feet, the return air may travel through the first floor space to furnace air inlet grilles located at or above the first floor level.
- e. Public halls or public stairs shall not be used as plenums.
- f. The return system and circulating fan 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.

SECTION 20

WARM AIR HEATING, AIR CONDITIONING, AIR COOLING AND VENTILATING SYSTEMS OF OTHER THAN RESIDENTIAL TYPE

20.1 APPLICATION.

- a. This section shall apply to air duct systems employing mechanical means for the movement of air and used for heating and ventilating including warm air heating systems, plain ventilating systems, combination heating and ventilating systems, air cooling systems, air conditioning systems, and exhaust systems except that it does not apply to systems in residences nor to systems for removal of flammable vapors and residues nor to systems for conveying dust, stock or refuse by means of air currents.

20.2 CONSTRUCTION OF DUCTS.

- a. Ducts shall be constructed of iron, steel, aluminum or other approved materials such as clay or asbestos cement, or of material as provided in 20.2.b and 20.2.c.
- b. Listed Class 1 air ducts shall be permitted provided they are not used for vertical risers serving more than two stories and are not used in assembly occupancy and the air duct system is not larger than 20,000 cfm and does not operate with an air temperature higher than 250°F. entering the ducts.
- c. Listed Class 1 air ducts shall be permitted provided they are not used in buildings more than two stories in height and are not used in assembly occupancy and the air duct system is not larger than 16 feet in maximum inside perimeter and does not operate with an air temperature higher than 250°F. entering the duct.
- d. The materials, thickness and construction of sheet metal ducts shall provide structural strength and durability so as to be reasonably safe to persons and property in accord with Air Conditioning and Ventilating Systems, NFPA No. 90A-1968.
- e. Ducts may be of independent construction or a part of the building structure, provided that they conform to the requirements of this section. Construction consisting of not less than 3/4 inch cement or gypsum plaster on metal lath applied to either combustible or noncombustible supports may be used as duct walls.

- f. Flexible duct connectors for use between ducts and 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 exceed 20 square inches in cross sectional area when penetrating a floor. They shall not pass through any floor unless they possess a flame spread rating of not over 25 without evidence of continued progressive combustion and with a smoke developed rating not higher than 50 or designated "Light or Negligible".
 4. Except as provided in 20.2.f.3, connectors not exceeding 8 inches in diameter shall possess a flame spread rating of not over 50 without evidence of continued progressive combustion.
 5. Connectors exceeding 8 inches in diameter shall possess a flame spread rating not over 25 without evidence of continued progressive combustion and with a smoke developed rating not higher than 50.
 6. They shall not exceed 12 feet in length.
 7. They shall not pass through any fire wall or fire partition.
 8. They shall be encased with not less than one-half inch of noncombustible insulating material or shall be located in an enclosure of noncombustible construction.
 9. They shall be constructed to resist damage during installation, and deformation or collapse in use.
- g. Vibration isolation connectors in duct systems, other than as covered by 20.2.h, 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 fabric shall not exceed 10 inches in length.
- h. 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 20.2.g, if not over 10 inches in length.
- i. Linings, coverings and insulations including vapor barriers shall have a flame spread rating not over 25 without evidence of continued progressive combustion and with a smoke developed rating not higher than 50. If the linings, coverings and insulations including vapor barriers are to be applied with adhesives, they shall be tested as applied with such adhesives, or the ad-

hesives used shall have a flame spread rating not over 25 and a smoke developed rating not higher than 50.

- j. 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 repaired.
- k. 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.
- l. If inspection windows are required, approved wired glass shall be used.
- m. Tape used for sealing joints shall be not more combustible than approved flameproofed fabric.

20.3 CLEAN-OUT 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.
 - 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. Clean-out openings at approximately 20-foot 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 clean-out openings.
- c. Supply ducts, other than vertical, shall conform to 20.3.a and 20.3.b, unless all of the supply air passes through either water spray or filters.

20.4 INSTALLATION OF DUCTS.

- a. Ducts shall not be built into a building in such a way to impair the effectiveness of the fireproofing around steel or iron structural members such as placing ducts between the fireproofing and members protected, except in the case of structural members 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. Main vertical ducts which pass through floors of buildings in which vertical openings are required to be protected shall be enclosed with approved non-combustible materials having a fire resistance rating of not less than one hour when such ducts are located in a building less than 4 stories in height, and not less than 2 hours when such ducts are located in a building 4 stories or more in height.
- d. 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.
- e. 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.
- f. 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.
- g. A branch duct having a cross sectional area of less than 20 square inches which passes through one floor only and pierces the floor at one point only to supply air conditioning units on one story only is not required to be encased. Where such a branch serves connectors which pierce the floor at more than one point, the portion of the duct below the floor shall be covered with not less than 1/2 inch of noncombustible insulating material or it shall be enclosed with noncombustible material or it shall be enclosed with noncombustible material such as by locating above a noncombustible ceiling.
- h. Public exit corridors shall not be used as plenums. Stairs shall not be used as plenums.
- i. Ducts shall be substantially supported. Hangers and brackets for supporting ducts shall be of metal.
- j. No attic, basement or concealed space in a building shall be used as an integral part of a duct system unless it conforms to all the requirements for ducts. Such arrangements shall be subject to the approval of the Bureau. Plenum chambers which conform to all the requirements for ducts may be located in any such portion of the building; such chambers shall not be used for storage or occupational purposes. When a concealed space formed by a ceiling and floor above is used as a plenum chamber, the installations shall conform with the appropriate provisions in 20.4.k and 20.4.l.

- k. Where fire-resisting ceilings acting as a component of floor and ceiling assemblies which have been tested and obtained not less than a one hour fire resistance rating are used in accordance with 20.4.j:
1. No combustible materials shall be incorporated in the floor and ceiling construction.
 2. The area of openings in such ceilings shall not exceed the proportionate areas of such openings in the assembly tested.
 3. The integrity of fire-stopping shall not be destroyed.
 4. They shall have been tested for the intended use — supply or return plenums.
 5. Electrical wiring in concealed spaces used as part of the air distribution system shall be listed.
- l. Where other than fire-resisting ceilings covered by 20.4.k are used in accordance with 20.4.j:
1. They shall be made from a base material of metal or mineral.
 2. All surfaces of the ceiling material shall possess a flamespread rating of not over 25 without evidence of continued progressive combustion, and with a smoke developed rating of not higher than 50 or designed "Light" or "Negligible."
 3. The ceiling material shall be supported by noncombustible material which if of metal shall have a melting point above 1400°F.
 4. They shall not be subject to deterioration or deformation on long exposure to temperatures of 250°F., or under conditions of high humidity, excessive moisture or mildew.
 5. The ceiling material shall be constructed to resist deformation or collapse during installation and use.
 6. No combustible materials shall be in the concealed space.
 7. Electrical wiring in concealed spaces used as part of the air distribution system shall be listed.
 8. They shall not be used on systems which operate with an air temperature higher than 250°F. entering the air ducts.
 9. They shall not be used in assembly occupancies.

20.5 CLEARANCES FROM WARM AIR DUCTS.

- a. Metal warm air ducts shall be installed with clearances to combustible material as follows:
 1. As provided in 19.4.b.1 and 19.4.b.2, except that beyond the distance from the plenum, the clearance shall be not less than $\frac{1}{2}$ inch.
 2. As provided in 19.4.b.3.
- 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.

20.6 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. Such fire doors shall be listed for the protection of openings in fire walls (Class A openings), except that for small openings not exceeding 18 inches in diameter, $\frac{3}{8}$ inch steel plates may be used in lieu of fire doors, or fire dampers, may be used when approved. Suitable hand hole openings shall be provided to make all fire doors and dampers in ducts accessible for inspection and servicing.
- b. A listed fire damper shall be provided on each opening through a required two-hour partition and each opening through the wall of a required enclosure of a vertical opening.
- c. Where duct systems serve two or more floors the main vertical duct shall be protected with approved fire dampers at (1) each direct outlet or inlet at the junction of each branch duct or (2) at each point where such vertical duct pierces a floor it serves. Dampers are not required at room openings in branch ducts. Dampers are not required in branch ducts having a cross-sectional area of less than 20 square inches which supply only air conditioning units discharging air at not over 4 feet above the floor.
- d. Fire dampers provided in ducts used solely for exhaust of air to the outside, shall be installed in such a way that they will not interfere with the flow of air in the main duct. No dampers are required in a system serving only one floor and used only for exhaust of air to the outside. Where direction of exhaust air flow is upward, sub-ducts at least 22 inches in length may be carried up inside the main duct from each inlet, in lieu of dampers.
- e. Aluminum ducts which pass through floors of fire-resistive construction, unless encased as specified in 20.4.c, shall have approved fire dampers at the floors.

20.7 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.

20.8 AIR INLET AND OUTLET OPENINGS.

- a. 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.

20.9 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.

20.10 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 re-start the fan after the thermostat has operated.

APPENDIX A

AVAILABILITY OF REFERENCED STANDARDS AND PUBLICATIONS

A.1 AVAILABILITY FOR INSPECTION.

A copy of each of the standards and publications referenced in this Chapter is on file and may be inspected at the following office of the Bureau of Engineering and Safety between the hours of 9:00 A.M. and 4:00 P.M. on normal working days:

Bureau of Engineering and Safety
Department of Labor and Industry
John Fitch Plaza, Rm. 1103
Trenton, New Jersey

A.2 AVAILABILITY BY PURCHASE.

Copies of the referenced standards and publications may be purchased from the organizations listed below. The abbreviations preceding these standards and publications have the following meaning and are the organizations issuing the standards and publications listed.

ANSI - American National Standards Institute
1430 Broadway
New York, N.Y. 10018

ASTM - American Society for Testing and Materials
1916 Race Street
Philadelphia, Pa. 19103

NFPA - National Fire Protection Association
60 Batterymarch Street
Boston, Mass. 02110

NJAC - New Jersey Administrative Code
Division of Administrative Procedure
Department of State
10 North Stockton Street
Trenton, N.J. 08608

No. and Edition	Title	Price/Copy
ANSI Z21.43-1963	Approval Requirements for Unvented Infrared Radiant Heaters	\$1.50
ANSI Z21.51-1967	Approval Requirements for Vented Gas Fired Infrared Radiat Heaters	1.50
ASTM E119-1967	Fire Tests of Building Construction and Materials	1.50
NFPA No. 31-1968	Oil Burning Equipment	1.25
NFPA No. 54-1969	Gas Appliances and Gas Piping	0.75
NFPA No. 54A-1969	Gas Piping and Gas Equipment on Industrial Premises and Certain Other Premises	0.75
NFPA No. 85-1967	Fuel Oil and Natural Gas Fired Watertube Boiler Furnaces, One Burner	0.75
NFPA No. 86A-1969	Ovens and Furnaces	1.50
NFPA No. 85B-1969	Natural Gas Fired Public Utility Boiler-Furnaces	0.60
NFPA No. 85D-1969	Fuel Oil Fired Multiple Burner Boiler-Furances	0.60
NFPA No. 90A-1968	Air Conditioning and Ventialting Systems	0.75
N.J.A.C. 9C:20	Air Pollution Control Code	No Charge

Part 2

CONSTRUCTION SAFETY ACT

Chapter 180. Construction Safety Code—7/1/68.

Part 3

MINE SAFETY ACT

Chapter 185. Pits and Quarries, SR No. 12—2/15/60.

Part 4

EXPLOSIVES ACT

Chapter 190. Explosives Permits and Fees, SR No. 20—1/15/62.

Chapter 191. Transportation of Explosives, SR No. 21—12/14/62.

Chapter 192. Storage of Explosives, SR No. 22—8/20/65.

Chapter 193. Use of Explosives, SR No. 23—8/20/65.

Chapter 194. Rocket Experimentation by Amateurs, SR No. 24—11/1/63.

Part 5

LIQUEFIED PETROLEUM GAS ACT

Chapter 200. Liquefied Petroleum Gas, SR No. 50—8/15/69.

Part 6

TRANSPORTATION OF DANGEROUS ARTICLES ACT

Chapter 205. Transportation by Motor Carrier of Dangerous Articles—
9/11/50.

CONVERSION TABLE

SR No.	Chap.	SR No.	Chap.	SR No.	Chap.
1	161	10	170	24	194
2	130	11	160	30	110
3	131	12	185	40	120
4	145	19	122	41	121
5	140	20	190	50	200
6	141	21	191	57	132
8	146	22	192	71	143
9	142	23	193	72	144

LAW REPRINTS

Construction Safety Act—P.L. 1962, c.45
Explosives Act—P.L. 1960, c. 55
Fireworks Regulation Law—P.L. 1930, c. 42 and P.L. 1937, c. 51
High Voltage Proximity Act—P.L. 1948, c. 249 and P.L. 1966, c. 261
Liquefied Petroleum Gas Act—P.L. 1958, c. 43
Mine Safety Act—P.L. 1954, c. 197
Railroad and Airline Sanitation—P.L. 1966, c. 112
Railroad Diesel Locomotive Ventilation—P.L. 1966, c. 119
Transportation of Dangerous Articles—P.L. 1950, c. 128
Worker Health and Safety Act—P.L. 1965, c. 54

INDUSTRIAL SAFETY GUIDES

No.	Title
1	Lift Safely
3	Protection for the Eyes and Head
4	Safety Awards Program
5	First Aid Fire Protection Equipment
6	Simple Mechanics for the Safety Man
7	Accident Prevention
8	Chemistry for the Safety Man
9	Portable Electric Power Tools
10	Safety Committee
11	Accident Investigation
12	Static Electricity

OTHER PUBLICATIONS

Annual Analysis of Work Injuries in New Jersey

AVAILABILITY OF PUBLICATIONS

All publications are distributed free except as follows:

1. There is a charge of 50c per copy for Chapter 180, Construction Safety Code.
2. There is a charge of 10c for each copy of any one publication in excess of ten.
3. There is a charge of \$5.00 per copy for Chapter 115, The Standard Building Code of New Jersey which is available from the N.J. Department of Community Affairs, P.O. Box No. 2768, Trenton, New Jersey.

Checks for Labor and Industry publications should be made payable to the Commissioner of Labor and Industry.

All requests, except for Chapter 115, The Standard Building Code of New Jersey, should be addressed to:

Department of Labor and Industry
Bureau of Engineering and Safety
Post Office Box 709
Trenton, New Jersey 08625