NFPA

82

INCINERATORS, WASTE AND LINEN HANDLING SYSTEMS 1977

NATIONAL FIRE PROTECTION ASSOCIATION
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See Official NFPA Definitions at the back of this pamphlet.

Standard on

Incinerators, Waste and Linen Handling Systems and Equipment

NFPA 82 — 1977

This edition of NFPA 82 was adopted by the National Fire Protection Association in November, 1977 at the Fall Meeting in Atlanta, Georgia. It supersedes the 1972 edition of NFPA 82.

This edition represents a complete revision from the 1972 edition.

Origin and Development of NFPA 82

This standard was first adopted by the NFPA in 1948 on recommendation of the Committee on Field Practice. In 1953 a completely revised edition of the text on incinerators was prepared by a representative subcommittee and adopted by the NFPA on recommendation of the Committee on Building Construction. The subject of incinerators was turned over to the Committee on Chimneys and Heating Equipment in 1956. Revised editions were adopted in 1955, 1958, 1960, 1969, 1970, 1971 and 1972. The original 1948 text covered both rubbish handling and incinerators; the 1953, 1955, 1958 and 1960 revisions covered only incinerators. In the 1960 edition, incinerators and rubbish handling were treated as separate standards, Nos. 82 and 82A respectively, No. 82A on Rubbish Handling being unchanged from the 1948 edition. In the 1969 edition, the subject Rubbish Handling was included with incinerators and Standard No. 82A was discontinued as a separate standard.

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Standard on

Incinerators, Waste and Linen Handling Systems and Equipment

NFPA 82 — 1977

Chapter 1 General

1-1 Scope.

1-1.1 This standard represents basic requirements primarily concerned with reducing the fire hazards encompassing the installation and use of incinerators, waste handling systems, linen (laundry) handling systems, compactors, and waste storage rooms and containers.

1-1.2 This standard does not include design criteria for the purpose of reducing air pollution. For such criteria, consult the authorities having jurisdiction.

1-2 Definitions.

1-2.1 Combustible Material. Combustible material, as pertaining to this standard, means material made of or surfaced with wood, compressed paper, plant fibers, or other material that will ignite and burn. Such material shall be considered as combustible even though flameproofed, fire-retardant treated, or plastered.

1-2.2 Other definitions relating to this standard are contained in the *Standard Glossary of Terms Relating to Chimneys, Vents, and Heat Producing Appliances*, NFPA 97M–1972.

1-3 Application of Standard. This Standard shall be applied to new construction and new equipment, as determined by the authority-having jurisdiction. It shall not require the alteration or replacement of existing construction or equipment currently in use provided that the owner establishes appropriate administrative, maintenance and training programs that give equivalent safety.

Chapter 2 Incineration

2-1 General.

2-1.1 Provision for Auxiliary Fuel. Gas burning installation shall be in accordance with applicable provisions of NFPA 54, *National Fuel Gas Code* and NFPA 58, *Storage and Handling of Liquefied Petroleum Gases.* Oil-burning installations shall comply with the *Standard for the Installation of Oil Burning Equipment,* NFPA 31–1974. Fuel burners of all incinerators shall be equipped with safety controls which will automatically shut off the fuel supply to the burner in the event the burner fails to ignite or its flame becomes extinguished or in the event of insufficient draft.

2-1.2 Electrical Supply. The electrical supply to an incinerator shall be installed in accordance with the *National Electrical Code,* NFPA 70–1978.

2-1.3 Air for Combustion and Ventilation.

2-1.3.1 Provision shall be made for an adequate supply of air for combustion and ventilation to enter the room in which an incinerator is located. Fans may be installed to deliver air to the incinerator room, provided they are in operation whenever the incinerator is in use.

2-1.3.2 If a residential-type of incinerator is installed in an open area, such as an undivided basement without storm windows and without unusually tight fitting doors, in buildings of conventional construction, adequate air supply may usually be obtained through normal air infiltration. If the incinerator is located in a confined space or an area separated by tight-fitting partitions and doors, adequate air shall be provided by means of an opening communicating with other areas of the building having adequate infiltration or with the outdoors. See NFPA 31–1974, *Standard for the Installation of Oil Burning Equipment.*

2-1.3.3 Rooms in which incinerators other than residential types are installed shall be furnished air for combustion and ventilation by one of the following means:

(a) A screened or louvered ventilator opening or other suitable air intake. If communicating to other parts of the building, the opening shall be protected by an approved fire damper.

(b) A duct leading from the incinerator room to the outdoors.

(c) A duct leading to a boiler or furnace room cut off as prescribed in 2-2.10 or 2-3.6, and provided with sufficient air supply for both rooms.

2-1.3.4 The opening or duct specified in 2-1.3.3 shall have a free area of not less than 1 sq. in. per 4,000 Btu per hour incinerator burning rate based on heat value of waste and auxiliary fuel, if all air is from the outdoors; and 1 sq. in. per 1,000 Btu per hour incinerator burning rate if all air is from inside buildings. See the *National Fuel Gas Code*, NFPA 54–1974.

2-1.3.5 Air ducts extending to or from an incinerator room through other parts of a building shall be constructed and installed in accordance with the *Standard for the Installation of Air Conditioning and Ventilating Systems*, NFPA 90A–1976.

2-1.4 Spark Arresters.

2-1.4.1 Spark arresters shall be used.

2-1.4.2 The net free area of the arrester shall be not less than four times the net free area of the outlet of the chimney flue it serves.

2-1.4.3 Arresters shall have a vertical height of not less than 1.3 times the minimum diameter of the chimney flue or the minimum horizontal dimension of rectangular chimney flue.

2-1.4.4 Arresters, including bolts, rivets, screws and supporting members, shall be made of stainless steel (ASTM A167,[1] Type 316, or ASTM A478, Type 316, or the equivalent).

2-1.4.5 Openings shall not permit the passage of spheres having a diameter larger than one-half inch, nor block the passage of spheres having a diameter of less than three-eighths inch.

2-1.4.6 Means shall be provided for securely attaching the spark arresters to chimneys to provide adequate support and prevent movement of the arrester.

2-1.4.7 Means shall be provided to replace spark screens.

2-2 Domestic Incinerators.

2-2.1 Definitions. A domestic incinerator is for the burning of ordinary combustible waste material and garbage incidental to residential occupancy and having a firebox of charging compartment of not over 5 cu. ft. of furnace volume. Domestic incinerators may be self-contained, factory-built units not requiring field construction, or may be of the built-in type designed to be encased in masonry or installed in a masonry wall or chimney.

[1]The full title and date of all references to ASTM standards in this standard appear in the Appendix.

2-2.2 Design and Construction.

2-2.2.1 The design shall be such that in service the incinerator will not crack, warp, or otherwise fail structurally so as to permit flame passage or emission of combustion gases or sparks into the building.

2-2.2.2 Explosion relief shall be provided. The area of explosion relief shall be not less than one square foot of relief area for every 100 cubic feet of primary combustion chamber volume. Where the chimney will not serve the above purpose, a door or panel shall be provided and arranged to allow the door or panel to return to a closed position promptly after pressure has been released.

2-2.2.3 Self-contained, factory-built domestic incinerators shall be approved types.

2-2.2.4 The enclosing walls for combustion chambers of built-in incinerators shall be constructed of clay or shale bricks not less than 4 inches in thickness with a lining of 4½ inches of high-duty fireclay refractory. Firebrick and mortars shall not be less than high-duty fireclay refractory complying with the requirements of ASTM C64–72, *Specifications for Refractories for Incinerators and Boilers.*

Exception: Other constructions may be used, if equivalent to the constructions outlined in 2-2.2 in structural strength, insulating value, and ability to withstand thermal expansion and flame impingement.

2-2.3 Placement. Incinerators shall be placed on the ground or on floors of fire-resistive construction with noncombustible flooring or surface finish and with no combustible material against the underside thereof, or on noncombustible slabs or arches having no combustible material against the underside thereof. Such construction shall extend not less than 18 in. beyond the front of the incinerator or side where ashes are removed and 12 in. beyond all other sides of the incinerator.

Exception No. 1: An incinerator which is listed specifically for placement on combustible floors shall be installed in accordance with the terms of such listing and the manufacturer's instructions.

Exception No. 2: An incinerator may be placed on floors other than as specified in 2-2.3 provided the incinerator is so arranged that flame or hot gases do not come in contact with its base and, further, provided the floor under the incinerator is protected with hollow masonry not less than 4 in. in thickness, covered with sheet metal of not lighter than 24 U.S. gage. Such masonry course shall be laid with ends unsealed and joints

matched in such a way as to provide a free circulation of air from side to side through the masonry. The floor for 18 in. beyond the front of the incinerator or side where ashes are removed and 12 in. beyond all other sides of the incinerator shall be protected with not less than ¼ in. asbestos millboard covered with sheet metal of not lighter than 24 U.S. gage or with protection equivalent thereto.

Exception No. 3: An incinerator which is set on legs that provide not less than 4 in. open space under the base of the incinerator may be placed on floors other than as specified in 2-2.3 provided the incinerator is such that flame or hot gases do not come in contact with its base and, further, provided the floor under the appliance is protected with asbestos millboard not less than ¼ in. thick covered with sheet metal not lighter than 24 U.S. gage. The above specified floor protection shall extend not less than 18 in. beyond the front of the incinerator or side where ashes are removed and 12 in. beyond all other sides of the incinerator.

2-2.4 Clearances.

2-2.4.1 The clearances above a charging door to combustible material shall be not less than 48 in.

Exception No. 1: Incinerators which are listed specifically for installation at lesser clearances shall be installed in accordance with the terms of such listing and the manufacturer's instructions, provided that, in any case, the clearances shall be sufficient to afford ready accessibility for firing, cleanout, and any necessary servicing.

Exception No. 2: The clearance may be reduced to 24 in. provided the combustible material is protected with sheet metal not lighter than 28 U.S. gage spaced out 1 in. on noncombustible spacers, or equivalent protection. Such protection shall extend 18 in. beyond all sides of the charging door opening.

2-2.4.2 An incinerator shall be installed to provide clearances between it and combustible material of not less than 36 in. at the sides, rear, and top and not less than 48 in. at the front.

Exception No. 1: Incinerators which are listed specifically for installation at lesser clearances shall be installed in accordance with the terms of such listing and the manufacturer's instructions, provided that, in any case, the clearances shall be sufficient to afford ready accessibility for firing, cleanout, and any necessary servicing.

Exception No. 2: Domestic incinerators may be installed with reduced clearances to combustible material when the combustible material is protected in accordance with Table 2-2.1 and Figure 2-2.1 of the Manual on Clearances for Heat Producing Appliances, NFPA 89M–1976. Clearances shall not be reduced in confined areas such as alcoves.

2-2.5 Chimneys for Domestic Incinerators.

2-2.5.1 Domestic incinerators shall be connected to chimneys.

Exception: Where domestic incinerators are installed in spaces open to outside air but provided with a cover or roof such as open sheds, breezeways, or carports, galvanized steel pipe not less than 20 galvanized sheet gage number or other equivalent noncombustible fire-and-corrosion-resistant material may be used provided the pipe is exposed and readily examinable for its full length and clearance not less than 18 in. is maintained from combustible material. The pipe shall extend at least 3 ft. above the highest point where it passes by or through a roof and at least 2 ft. higher than any portion of a building within 10 ft. If the pipe passes through a roof constructed of combustible material, it shall be guarded by a ventilating thimble of galvanized steel or approved corrosion-resistant noncombustible material extending not less than 9 in. below and 9 in. above the roof construction, and of a size to provide not less than 6 in. clearance on all sides of the pipe; or the combustible material in the roof construction shall be cut away so as to provide not less than 18 in. clearance on all sides of the pipe, with any material used to close up such opening entirely noncombustible.

2-2.5.2 Chimneys shall conform to the *Standard for Chimneys, Fireplaces, and Vents*, NFPA 211–1977.

2-2.5.3 An incinerator with integral vent shall be listed and shall be installed in accordance with the terms of the listing and the manufacturer's instructions.

2-2.5.4 An automatic draft control, if furnished with the incinerator, shall be installed in accordance with the instructions furnished with the incinerator.

2-2.6 Chimney Connector.

2-2.6.1 The clearance between a single-wall, metal pipe connector and unprotected combustible material shall be not less than 18 in. The clearance between a connector made of Type L venting-system piping and unprotected combustible material shall be not less than 9 in.

Exception: These clearances may be reduced if the combustible material is protected in accordance with the Standard for Chimneys, Fireplaces, and Vents, NFPA 211–1977.

2-2.6.2 A chimney connector shall not be enclosed. The connector throughout its entire length shall be readily accessible for inspection and replacement.

2-2.6.3 A chimney connector or vent connector shall not pass through any floor or ceiling.

2-2.6.4 A connector shall not pass through a wall or partition constructed of combustible material.

Exception: A connector may pass through a wall constructed of combustible material only when it is guarded at the point of passage by:

(a) Metal-ventilated thimble not less than 12 in. larger in diameter than the connector.

(b) Metal or burned fire-clay thimble built in brickwork or other approved fireproofing materials extending not less than 8 in. beyond all sides of the thimble.

(c) In lieu of a thimble, all combustible material in the wall or partition shall be cut away from the connector a sufficient distance to provide the clearance required from such connector. Any material used to close up such opening shall be noncombustible insulating material.

2-2.6.5 **Draft Hoods Prohibited.** Draft hoods shall not be installed on incinerators.

2-2.7 **Waste Chutes.** A waste chute shall not feed directly into a domestic incinerator.

2-2.8 **Instructions.** Instructions shall be posted in a permanent manner on the charging door of domestic incinerators warning against the introduction of loose dusty materials, flammable liquids or compounds, and closed containers and aerosol cans (empty or otherwise).

2-2.9 **Incinerator Rooms for Domestic Incinerators.** Incinerators shall be enclosed within a room separated from other parts of the building by wall, partition, floor or floor-ceiling assemblies having a fire resistance of not less than 1 hour, and used for no other purpose except storage of containers of waste materials to be burned, and building heating equipment.

Exception: In private dwellings occupied by not more than two families, a domestic incinerator need not be in a separate room provided minimum clearances prescribed for domestic incinerators in 2-2.4 are provided.

2-3 Commercial-Industrial Incinerators.

2-3.1 **Definition.** A commercial-industrial incinerator is one having a furnace volume in excess of 5 cu. ft.

2-3.2 **Design and Construction.**

2-3.2.1 The design shall be such that in service the incinerator will not crack, warp, or otherwise fail structurally so as to permit flame passage or emission of combustion gases or sparks into the building.

2-3.2.2 Explosion relief shall be provided. The area of explosion relief shall be not less than one square foot of relief area for every 100 cubic feet of primary combustion chamber volume. Where the exhaust chimney will not serve the above purpose, a door or panel shall be provided and arranged to allow the door or panel to return to a closed position promptly after pressure has been released.

2-3.2.3 Commercial-industrial incinerators shall be built in accordance with the following requirements:

(a) All combustion shall take place within the combustion chamber designed for combustion temperatures. Combustion shall not take place in breeching or chimneys unless they are designed as combustion chambers.

(b) Incinerators designed for positive pressures shall be gas tight.

(c) The combustion chamber, inner walls, roofs, bridges, walls, and curtain walls shall be so constructed as to withstand the combustion temperatures involved and shall maintain their integrity under all operating conditions. Metal stays, lintels, or other supports shall not be exposed to the interior of the combustion chamber.

(d) An exterior masonry casing shall be reinforced with structural steel framework and an exterior steel casing shall be reinforced with structural steel members, such that the casing will withstand interior thrusts from arches and be capable of supporting all doors and burner equipment. The steel casing or framework shall be erected and set plumb before any brickwork is done. Cylindrical outer casings made of steel not less than ¼ inch thick need not be reinforced.

(e) Insulation shall be used between the external casing and the inner walls as required to meet the temperature limitations of 2-3.2.5.

(f) Openings shall be provided so that all parts of the incinerator can be cleaned, including the ash pit, the combustion chamber, the passes of separation chambers, and the incinerator flue. Cleanouts shall be closed by tight-fitting doors or covers, securely latched or otherwise held in a closed position. Ash pit and combustion chamber closures and frames shall be of cast iron or equivalent, with the frames securely attached to the incinerator.

2-3.2.4 No part of an incinerator shall be used as a wall, roof or floor of a building.

2-3.2.5 Incinerators shall be so designed that the temperature rise above ambient (75°F ±5°) of any portion of the incinerator casing accessible to an operator shall not exceed 70°F. Handles of operating doors shall not exceed a 40°F rise for metallic and 60°F rise for nonmetallic.

Exception: Doors, inspection points, burners, flues, and areas immediately adjacent thereto need not comply with 2-3.2.4.

2-3.3 Placement. Commercial-industrial incinerators shall be placed on properly designed foundations of masonry or reinforced concrete or on noncombustible material having a fire resistance rating of not less than 3 hours provided such support is independent of the building construction and the load is transferred to the ground.

2-3.4 Clearances.

2-3.4.1 Commercial-industrial incinerators shall be installed to provide a clearance to combustible material of not less than 36 in. at the sides and rear, and not less than 48 in. above, and not less than 8 ft. at the front of the incinerator.

Exception: For a commercial-industrial incinerator encased in brick the clearance above may be 36 in. and at the sides and rear it may be 18 in.

2-3.4.2 A clearance of not less than 12 in. shall be provided from the incinerator to walls or ceilings of noncombustible construction.

Exception: A clearance of not less than 3 in. may be provided from commercial and industrial incinerators to walls or ceilings of noncombustible construction where it is not possible to place combustible material on the outer or upper side thereof.

2-3.4.3 Incinerators which are listed specifically for installation at lesser clearances than specified in 2-3.4.1 and 2-3.4.2 shall be installed in accordance with the conditions of such listing, provided that, in any case, the clearances shall be sufficient to afford accessibility for firing, cleanout, and any necessary servicing as set forth in 2-3.4.4.

2-3.4.4 Sufficient space shall be provided around the incinerator and its appurtenances to facilitate cleaning, repair, and servicing. Clearance shall be provided to allow the cleanout doors to be completely opened so that all parts of the combustion

chamber, ash pit, separation chambers, etc., may be reached and so implements used for this purpose can be freely manipulated. All dampers, gates, burners, valves, levers, etc., shall be accessible for repair and adjustment or replacement. No construction shall be located closer than 16 in. to any part of an incinerator.

Exception: Noncombustible structural member 2 ft. wide or less, parallel to the incinerator, may be located as close as 6 in. to the incinerator, provided such members do not reduce accessibility to any moving parts of the incinerator.

2-3.5 Charging Hood and Chute. (*See 3-3.5.*)

2-3.5.1 The combustion chamber of a commercial-industrial type incinerator may be charged through the floor immediately above such incinerator.

2-3.5.2 The charging hood and chute shall be constructed of not less than 12 U.S. gage steel casing, lined with not less than 4½ in. of firebrick (ASTM C64 Type F, medium duty, or the equivalent). Such charging hopper shall not exceed 6 ft. in length measured from the floor opening to the outside of the roof of the incinerator combustion chamber.

Exception: The charging hood and chute may exceed 6 ft. in length if approved means are provided to prevent the charging hood and chute from discharging gases resulting from combustion into the charging room.

2-3.5.3 The charging opening shall be protected by a cover extending beyond the edges of the opening for at least 2 in. on all sides, and lined with not less than 2½ in. of refractory material.

2-3.5.4 The charging floor opening shall be located in a room with walls and floor and ceiling assemblies having a fire resistance rating of not less than 2 hours, with openings protected by approved self-closing or automatic-closing 3-hour fire doors suitable for Class A openings. Such doors shall be kept closed during the charging operation; also at other times except when delivering waste material to the room.

Exception: When the room is protected by an approved system of automatic sprinklers, the walls, and floor and ceiling assemblies may have a fire resistance rating of not less than 1 hour and the door may be a 1½-hour fire door approved for Class B openings.

2-3.6 Incinerator Rooms for Commercial-Industrial Incinerators.

2-3.6.1 Commercial-industrial incinerators shall be enclosed within a room separated from other parts of the building by wall, partition, floor, and floor-ceiling assemblies constructed

of noncombustible material and having a fire resistance rating of not less than 2 hours and used for no other purpose.

Exception: Storage containers of waste material to be burned and building heating equipment may be located in the incinerator room.

2-3.6.2 Door or other openings in rooms containing incinerators communicating with other areas of the building shall be protected by approved self-closing or automatic-closing 1½-hour fire doors suitable for Class B openings.

2-3.6.3 Automatic sprinklers, a short length of hand hose connected to a suitable water supply, and a suitable floor drain shall be provided in the incinerator room.

2-3.7 Chimneys for Commercial-Industrial Incinerators.

2-3.7.1 General.

2-3.7.1.1 The chimney flue for a commercial-industrial incinerator shall serve the incinerator only. It shall be designed and proportioned to provide adequate draft for proper operation of the incinerator.

2-3.7.1.2 Chimneys shall be supported on properly designed foundations of masonry or reinforced portland or refractory cement concrete. They shall be so constructed as not to place excessive stress upon the roof of the combustion chamber. If incinerator walls are to support the chimney, the foundation and walls shall be built to support the load imposed.

Exception: Masonry chimneys may be supported on noncombustible material having a fire resistance rating of not less than 3 hrs. where such supports are independent of the building construction and the load is transferred to the ground.

2-3.7.1.3 A factory-built chimney, if so listed, and a metal chimney may be supported additionally at intervals by the building structure, in which case expansion joints shall be provided at each support level. All joints shall be liquid tight or of a design such that liquid will drain to the interior of the chimney.

2-3.7.1.4 Cleanout openings provided in chimneys shall be equipped with ferrous metal doors and frames arranged to remain tightly closed when not in use. A clearance of not less than 36 in. shall be provided between cleanout doors and combustible material.

2-3.7.1.5 Drains shall be provided at the base of all chimneys to allow the removal of condensed flue products and shall be designed to avoid clogging.

2-3.7.2 Listed Medium-heat Chimneys. Listed medium-heat appliance chimneys may be used and shall be installed in accordance with the conditions of the listing and the manufacturer's instructions.

2-3.7.3 Metal Chimneys.

2-3.7.3.1 Where secondary combustion temperatures do not exceed 1800°F, metal chimneys shall be lined with 4½ in. of high-duty, spall-resistant firebrick (ASTM C64) laid in high-duty refractory mortar (ASTM C105). The lining shall start at the base of the chimney and extend continuously to the top. Equivalent linings of equivalent thickness, such as Class A or better Alumina-Silica Base Castable Refractories or Class O or better Insulating Castable Refractories, may be used. Equivalent thickness shall be that thickness capable of providing the same insulating and structural values to limit skin temperatures to those specified in 2-3.2.5 under all intended operating conditions.

2-3.7.3.2 Where secondary combustion temperatures exceed 1800°F, metal chimneys shall be lined with 4½ in. of super-duty, spall-resistant refractory brick (ASTM C64) laid in refractory mortar. The refractory mortar shall be high-duty for temperatures up to 2730°F and super-duty or better for temperatures up to 2910°F. The lining shall start at the base of the chimney and extend continuously to the top. Equivalent linings of equivalent thickness, such as Class B or better Alumina-Silica Base Castable Refractories (ASTM C64) in accordance with temperature requirements or Class P and Q Insulating Castable Refractories (ASTM C64) in accordance with temperature requirements, may be used. Equivalent thickness shall be that thickness capable of providing the same insulating and structural values to limit skin temperatures to those specified in 2-3.2.5 under all intended operating conditions.

2-3.7.3.3 Castable plastic refractories, or other refractories, may be used in metal chimneys in lieu of firebrick provided such refractory is of equivalent heat and corrosion resistance. Liners made of these refractories shall be supported by anchors made of corrosion resistant steel capable of supporting the refractory load at 1500°F. The insulating value shall be such that temperatures at the supports shall not exceed this temperature under all firing conditions.

2-3.7.3.4 Metal chimneys shall be properly riveted or welded, securely supported and constructed in accordance with good engineering practice.

2-3.7.3.5 Metal chimneys shall be constructed of steel or cast iron. Sheet steel shall have a thickness not less than that indicated in Table 2-3.7.3.5.

Table 2-3.7.3.5 Minimum Thickness of Sheet Steel Chimneys

Mfgr. Std. Gage No.	Min. Thickness in. (mm)	Area $in.^2/m^2$	Equiv. Round Diam. in./mm
16	.054 (1.37)	up to 154/.0994	up to 14/356
14	.069 (1.75)	155/.0999 to 201/.1296	over 14/356 to 16/406
12	.098 (2.49)	202/.1303 to 254/.1638	over 16/406 to 18/457
10	.128 (3.25)	Larger than 254/.1638	over 18/457

NOTE: Regardless of minimums in this table, the thickness of sheet metal shall be adequate to meet the requirements of 2-3.7.3.6.

2-3.7.3.6 Metal chimneys shall be properly riveted, welded or bolted, securely supported and constructed in accordance with good engineering practice as necessary for the following:

(a) Strength to resist stresses due to steady or gusting wind loads.

(b) Adequate anchoring, bracing, and inherent strength to withstand seismic and wind-induced vibrational stresses.

(c) Proper material thickness for durability considering fuel analysis, gas temperature, and exposure.

(d) Security against leakage of flue gases under positive pressure.

(e) Allowance for thermal expansion of breeching and vertical sections.

2-3.7.3.7 If a metal chimney extends through any story of a building above that in which the connected incinerator is located, it shall be enclosed in such upper stories within continuous walls constructed of materials which are noncombustible, such as masonry (*see 1-2.7*), and extending from the ceiling of the incinerator room to or through the roof so as to retain the integrity of the fire separations as required by applicable building code provisions. The walls shall have a fire resistance rating of not less than 1 hour if the building is less than 4 stories in height, and not less than 2 hours if the building is 4 or more stories in height, and shall conform to the following:

(a) The enclosure shall provide a space on all sides of the chimney sufficient to permit inspection and repair, but in no case shall it be less than 12 in.

(b) The enclosing walls shall be without openings.

Exception: Doorways equipped with approved self-closing 1½-hour fire doors approved for Class B openings may be installed at various floor levels for inspection purposes.

2-3.7.4 Masonry Chimneys.

2-3.7.4.1 Where secondary combustion temperatures do not exceed 1800°F, masonry chimneys shall be constructed of solid masonry units or reinforced concrete with walls not less than 8-in. thick. Such walls shall be lined with 4½ in. high-duty, spall-resistant firebrick (ASTM C64) laid in high-duty refractory mortar (ASTM C105). The lining shall start at the base of the chimney and extend continuously to the top.

2-3.7.4.2 Where secondary combustion temperatures exceed 1800°F, masonry chimneys shall be constructed with double walls of solid masonry units or reinforced concrete, each wall to be not less than 8 in. thick with an air space of not less than 2 inches between them. The inside of the interior wall shall be lined with 4½-in. super-duty, spall-resistant firebrick laid in super-duty refractory mortar (ASTM C64). The lining shall start at the base of the chimney and extend continuously to the top.

2-3.7.4.3 Masonry chimneys shall be proved air tight by a smoke test after erection and before being put into service.

2-3.8 Chimney Clearances.

2-3.8.1 Listed chimneys shall be installed in accordance with the conditions of the manufacturer's instructions as to clearances. Exposed portions of chimney or breechings that can be touched shall be so designed that maximum surface temperatures shall not exceed 70°F above ambient temperature.

2-3.8.2 Masonry Chimneys. A clearance of not less than 4 inches shall be provided between the exterior surface of masonry chimneys and combustible material.

2-3.8.3 Exterior Metal Chimneys.

2-3.8.3.1 Exterior metal chimneys shall have a clearance of not less than 24 inches from a wall of wood frame construction and from any combustible material.

2-3.8.3.2 Exterior metal chimneys over 18 in. in diameter shall have a clearance of not less than 4 in., and those 18 in. or less in diameter a clearance of not less than 2 in. from a building wall of other than wood frame construction.

2-3.8.3.3 An exterior metal chimney shall be installed with a minimum clearance of 24 in. to any door or window or to any walkway, unless insulated or shielded in any approved manner to avoid burning a person who might touch the chimney.

2-3.8.4 Interior Metal Chimneys.

2-3.8.4.1 Within the same story of a building as that in which the incinerator is located, a metal chimney shall have a clearance of not less than 36 in. from a wall of wood frame construction and from any combustible material. Such interior metal chimneys over 18 in. in outside diameter shall have a clearance of not less than 4 in., and those 18 in. or less in outside diameter a clearance of not less than 2 in. from a building wall of other than wood frame construction.

2-3.8.4.2 If a metal chimney passes through a roof constructed of combustible material, it shall be guarded by a ventilating thimble of galvanized iron or approved corrosion resistant metal, extending not less than 9 in. below and 9 in. above the roof construction, and of a size to provide not less than 18 in. clearance on all sides of the chimney.

2-3.9 Chimney Termination.

2-3.9.1 Chimneys on incinerators where the secondary combustion chamber is designed to be operated at 1800°F or less shall extend not less than 10 feet higher than any portion of any building within 25 feet.

Exception: Such portions do not include other chimneys, vents or open structural framing.

2-3.9.2 Chimneys on incinerators where the secondary combustion chamber is designed to be operated at over 1800°F shall extend not less than 20 feet higher than any portion of any building within 50 feet.

Exception: Such portions do not include other chimneys, vents or open structural framing.

2-3.9.3 The terminus of the chimney flue for the incinerator shall be equipped with an approved spark arrester if the incinerator does not include effective means for arresting sparks and fly ash (*see 2-1.4*).

2-3.9.4 Chimneys for incinerators of special design to produce low flue-gas temperatures shall adhere to the construction specified above. (*For further explanation, see 2-3.10.7.*)

2-3.10 Chimney Connector or Breeching.

2-3.10.1 A chimney connector or breeching connecting a commercial-industrial type incinerator to a chimney shall be constructed of not lighter than 16 U.S. gage steel if it is 12 in. or less in diameter or greatest cross-section dimension, and of not lighter than 12 U.S. gage steel if it exceeds 12 in. in diameter or greatest cross-section dimension.

Exception: Breechings may also utilize listed medium-heat chimney sections if these sections are joined together with continuous welds, flanges, or couplings.

2-3.10.2 Chimney connectors or breeching up to 18 in. in diameter or greatest cross-section dimension shall be lined with not less than 2½-in. high-duty, spall-resistant refractory brick (ASTM C64).

2-3.10.3 Chimney connectors or breeching over 18 in. in diameter or greatest cross-section dimension shall be lined with not less than 4½ in. of high-duty spall-resistant refractory brick (ASTM C64).

2-3.10.4 Castable plastic refractories, or other refractories, may be used in lieu of firebrick provided such refractory is of equivalent heat and corrosion resistance. Liners made of these refractories shall be supported by anchors made of corrosion resistant steel capable of supporting the refractory load at 1500°F. The insulating value shall be such that temperatures at the supports shall not exceed this temperature under all firing conditions.

2-3.10.5 The net internal free area of the connector shall be not less than the free area of the flue collar of the incinerator.

2-3.10.6 A chimney connector shall not be enclosed. The connector throughout its entire length shall be readily accessible for inspection and replacement.

2-3.10.7 Chimney connectors or breechings of all commercial-industrial type incinerators, including those of special design to produce low flue-gas temperatures, shall conform with 2-3.10.1 through 2-3.10.5.[1]

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[1]This requirement has been initiated to avoid the serious corrosion problems inherent with low-temperature incinerator flue gases. It also provides the high-temperature protection necessary when the special equipment is bypassed for any purpose, including power failure. In those cases where the bypass is such that the breeching is also bypassed, then the breeching need not be high-temperature protected but it shall be protected by an acid-resistant coating suitable for the operating conditions.

2-3.10.8 If a gas washer or scrubber is used or if other arrangements are such that the natural draft is insufficient for proper operation of the incinerator, a draft inducer may be used. In this event, the chimney shall be sized for natural-draft operation and a bypass installed around the gas washer or scrubber or other unit that requires the draft induction. Suitable normally open dampers shall be installed in the bypass to allow venting of combustion products in the event of power failure.

2-3.10.9 Expansion joints shall be provided as required.

2-4 Outdoor Incinerators. All outdoor incinerators shall conform with Chapters 2 and 3, depending upon use.

Chapter 3 Waste Chutes and Handling Systems[1]

3-1 Definitions. There are four types of waste chute systems, each with separate fire safety criteria.

3-1.1 General Access Gravity Type. A waste chute of this type is an enclosed vertical passageway in a building to a storage or compacting room where the waste is transferred by gravity only. All occupants of the building are free to use the chute at any time.

3-1.2 Limited Access Gravity Type. A waste chute of this type is an enclosed vertical passageway in a building to a storage or compacting room where the waste is transferred by gravity only. Authorized personnel only may use the chute, gaining entry by key to a locked chute door or service opening room door.

3-1.3 Pneumatic Waste Handling Systems. A waste handling system of this type is a vertical, horizontal, or inclined duct having sufficient mechanically applied air-flow to convey refuse without clogging to point of disposition.

3-1.4 Gravity-Pneumatic Waste Handling System. A system using a combination of the types defined in 3-1.1 through 3-1.3. The gravity type usually feeds into a pneumatic waste handling system.

3-2 Construction.

3-2.1 General.

3-2.1.1 A steel or steel-jacketed refractory chute supported at intervals by the building structure shall be provided with expansion joints between support levels. Other chutes shall be supported upon a substantial noncombustible foundation having a fire resistance rating of at least 3 hours.

3-2.1.2 Gravity chutes shall be constructed straight and plumb with no offsets. A minimum clearance of 24 in. shall be maintained from the outside edge of the discharge of the chute to any wall. All chute interiors shall be smooth and without projections.

Exception: When connected to a compactor or other device for processing the waste, clearance on two sides may be 4 in.

3-2.1.3 Listed medium-heat appliance chimney sections shall be acceptable for use as rubbish chutes.

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[1]Waste chutes, conveyors, or other handling systems are usually employed where there is a relatively large area on each floor from which rubbish is collected. The collected rubbish is brought to the opening in the chute. The chute then conveys the refuse to its disposition point.

3-2.1.4 Vertical rubbish chutes shall be enclosed in all stories above the storage or compacting room within a continuous enclosure constructed of materials which are noncombustible, and extending from the ceiling of the storage or compacting room to or through the roof so as to retain the integrity of the fire separation as required by applicable building code provisions. The walls of the enclosure or the walls of the masonry chute shall have a fire resistance rating of not less than 1 hour if the building is less than 4 stories in height and not less than 2 hours if the building is 4 or more stories in height. (*For pneumatic waste handling systems with horizontal runs, see 3-2.4.*)

Exception: Masonry chutes conforming to 3-2.2 or constructed of masonry walls having a fire resistance rating not less than specified above are not required to be enclosed.

3-2.1.5 The size of a refuse chute shall be in accordance with the following:

(a) **Gravity Type Chutes.** The size of the chute shall not be less than 22½ by 22½ in. or 24 in. in diameter, inside measurement.

(b) **Pneumatic Waste Handling Systems.** The size of the duct shall not be less than 16 in., inside measurement.

Exception: When all materials entering the pneumatic-powered chute are processed through a shredder the chute may be less than 16 in. in accordance with the authority having jurisdiction.

3-2.1.6 A waste chute shall extend (full size) at least 4 ft. above the roof of the building. The chute shall be open to the atmosphere.

3-2.2 **Masonry Waste Chutes.** Masonry waste chutes shall be constructed of clay or shale brickwork not less than 8 in. thick or of reinforced concrete not less than 6 in. thick. Such chutes shall be lined with low-duty refractory brick (ASTM C64), not less than 4½ in. thick. Equivalent construction with walls providing 2-hour fire resistance rating with equivalent structural features shall be acceptable.

3-2.3 **Metal Waste Chutes.**

3-2.3.1 Metal chutes may be lined with low-duty refractory brick (ASTM C64) not less than 2½-in. thick or equivalent castable refractories. Unlined steel chutes shall be protected internally by automatic sprinklers (*see 3-4.1*).

3-2.3.2 Metal waste chutes shall be made of stainless steel or galvanized or aluminum-coated steel with no screws, rivets, or

other projections on the interior surface of the chute. Laps or joints shall be of a design so that the liquid will drain to the interior of the chute. The steel shall not be lighter than as indicated below:

(a) Chutes handling general household or office wastes shall be made of steel not lighter than 16 U.S. gage.

(b) Chutes handling other than general waste, or dense-heavy waste material over 10 pounds per cubic ft., shall be made of steel not lighter than 14 U.S. gage.

3-2.4 Pneumatic Waste Handling Systems.

3-2.4.1 The minimum air velocity in a pneumatic waste handling system shall be not less than 5000 ft. per minute.

3-2.4.2 Risers on pneumatic waste handling systems shall be equipped with dampers which are open to the atmosphere except when automatically closed to permit a conveying operation in another riser. Immediately after completion of the conveying cycle, all riser dampers shall open automatically.

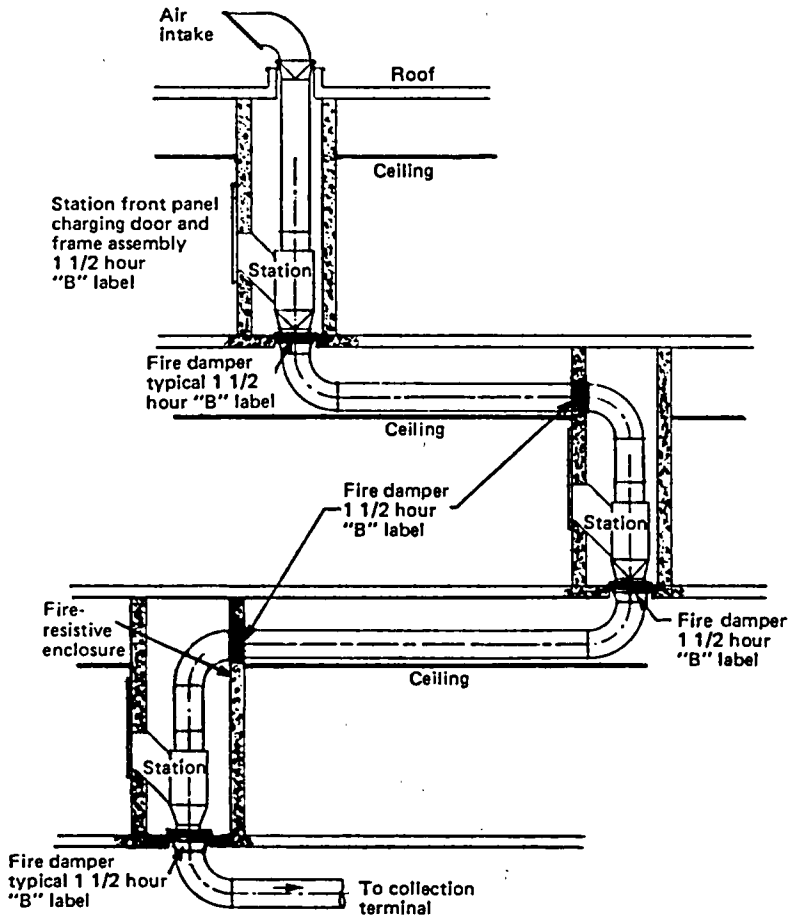
3-2.4.3 Metal thickness shall be not lighter than 20 U.S. gage steel for material conveying lines, but in all cases shall be of sufficient thickness to retain its design shape under all operating conditions. Charging stations or changes in direction of conveying lines shall be not lighter than 16 U.S. gage steel. Steel shall be galvanized, aluminized or stainless to avoid corrosion.

3-2.4.4 Pneumatic waste handling systems operating on a dual waste-linen mode shall have two separate service openings (stations) at each location, one for rubbish and one for linen. These must be sequenced to allow only one charge in the system at any given time and must be interlocked electronically to convey material to its proper destination.

3-2.4.5 Dual pneumatic systems which handle other materials in addition to waste shall be designed to operate in the rubbish mode in the event of electrical failure of any of the material diverter switch controls and immediately upon start-up after a scheduled or nonscheduled shut-down of the system.

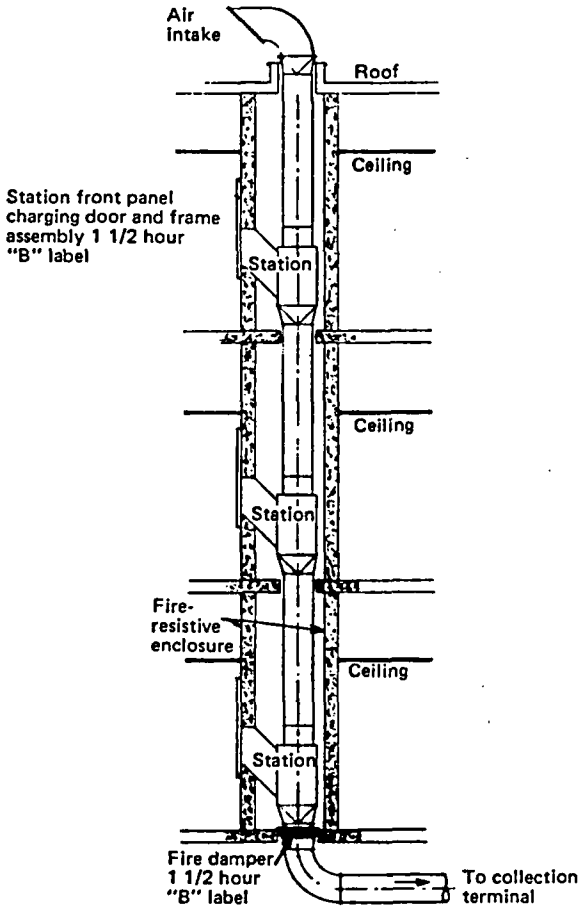
3-2.4.6 Automatic fire dampers shall be installed at all points where the waste handling system penetrates fire-resistive partitions or floor assemblies (*see Figure 3-2.4.6*). The system shall shut down automatically upon closing of one of the fire dampers.

Exception: When the waste handling system penetration of the floor assembly is enclosed by a fire-rated shaft both above and below the floor penetration, a fire damper is not required.



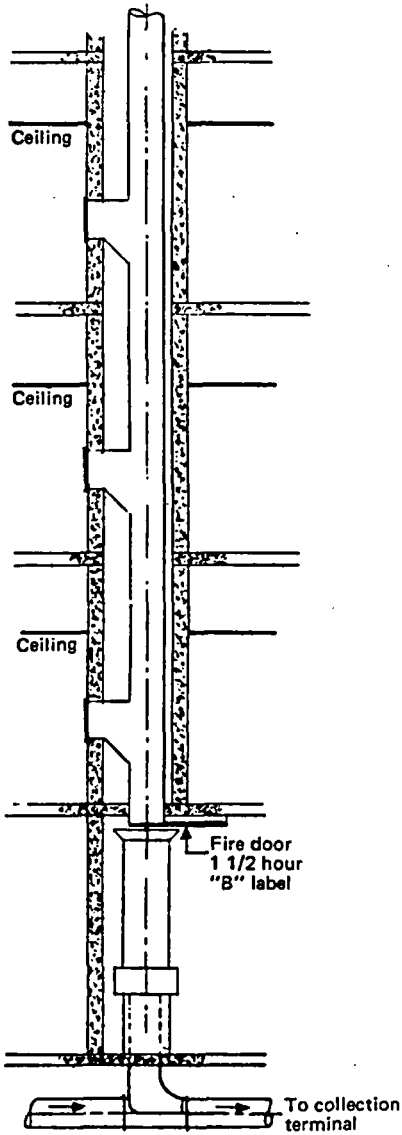
Typical Staggered Location of Stations
Full Pneumatic Linen and Trash System

Figure 3-2.4.6



Typical Straight Vertical Drop Full Pneumatic Linen and Trash System

Figure 3-2.4.6 (Continued)



Typical Straight Vertical Drop Gravity and Pneumatic Linen or Trash System

Figure 3-2.4.6 (Continued)

3-3 Chute Terminal Rooms.

3-3.1 Room Criteria. Waste chutes or pneumatic waste handling systems shall terminate or discharge directly into a room separated from other parts of the building by wall, partition, floor, and floor-ceiling assemblies having a minimum fire-resistive rating not less than that specified for the chute. Openings to such rooms shall be protected by approved automatic- or self-closing 1½-hour fire doors suitable for Class B openings.

3-3.2 Ventilation. Chute terminal rooms shall have a means of ventilation to the outdoors under fire conditions.

3-3.3 Automatic Sprinklers. Automatic sprinklers shall be installed in chute terminal rooms.[1] Hand hose of adequate length to reach all portions of the room shall be provided.

3-3.4 Discharge. Rubbish chutes or conveying systems shall not discharge directly into an incinerator.

3-3.5 Automatic Feeding or Stoking Systems. Systems for the automatic transfer of waste materials from a rubbish-chute terminal room to an incinerator or other means of automatic feeding or stoking incinerators shall not be installed unless special permission of the authority having jurisdiction has been obtained.[2]

3-4 Automatic Sprinklers.

3-4.1 Unlined Metal Chutes. Unlined metal gravity-type chutes shall be protected internally by automatic sprinklers. This requires a sprinkler at the top of the chute and, in addition, a sprinkler shall be installed within the chute at alternate floor levels in buildings over two stories in height. See *Standard for the Installation of Sprinkler Systems*, NFPA 13–1976.

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[1]Fires of the nature likely to occur at chute terminals are generally difficult to control by ordinary means due to the large amount of smoke evolved and consequent difficulty of access by the fire department. Automatic extinguishment of such fires in the incipient stage is, therefore, of primary importance.

[2]There are many situations where arrangements are made for handling refuse mechanically and automatic stoking of incinerators which would not introduce an unreasonable hazard. In such cases, the authority having jurisdiction may permit such an arrangement, taking into consideration the whole layout, its relation to the rest of the building, the presence or absence of complete sprinkler protection, the continuity and competence of the personal supervision attending the operation, ventilation, access for fire fighting, and similar factors. See also *Standard for the Installation of Blower and Exhaust Systems for Dust, Stock, and Vapor Removal or Conveying*, NFPA 91–1973.

3-4.2 Masonry Waste Chutes. Masonry rubbish chutes conforming to 3-2.2 shall not require automatic sprinklers.

3-4.3 Sprinkler Head Protection. Automatic sprinklers shall be installed in gravity waste chutes, or waste handling systems shall be recessed out of the chute area through which waste travels. The recessed area shall be so designed as to avoid collection of foreign matter in the recessed area.

3-5 Service Openings.

3-5.1 General Access Gravity-type Waste Chutes.

3-5.1.1 All service openings into a waste chute shall be provided with a self-closing, positive-latching, bottom-hinged hopper-type, frame and fire door assembly approved for Class B openings and having a fire protection rating of not less than 1 hour. The door frame shall be fastened into the chute and the shaft wall. The design and installation shall be such that no part of the frame or door will project into the chute.

3-5.1.2 The area of each service opening shall be limited to one-third of the cross-sectional area of a square chute and 44 percent of the area of a round chute.

3-5.2 Limited Access Gravity-type Waste Chutes.

3-5.2.1 All service openings into a waste chute shall be provided with a gasketed, self-closing, positive-latching frame and fire door assembly approved for Class B openings and having a rating of not less than one hour. The door frame shall be fastened into the chute and the shaft wall. The design and installation shall be such that no part of the frame or door will project into the chute. A key shall be required to open the door (*see 3-6.3*).

3-5.2.2 The area of each service opening shall be limited to two-thirds of the cross-sectional area of the chute.

3-5.3 Pneumatic Waste Handling Systems.

3-5.3.1 The service opening size of pneumatic waste handling systems shall be designed to provide proper entrance into the system. It may be equivalent to the cross-sectional area of the duct or greater.

3-5.3.2 Pneumatic waste handling systems shall be provided with a service opening consisting of two doors, including an automatic- or self-closing, positive-latching outer door, front panel, and frame assembly, approved for Class B openings and having a fire rating of not less than 1 hour. The door frame shall be built

firmly into the duct and wall. The system service opening shall be equipped with a second or inner door designed to remain closed at all times under full system pressure unless released by the system control circuit to allow the material placed inside the outer door to enter the duct, provided the outer door is closed. Only one inner service door shall be open during each conveying cycle.

3-5.4 Combined Gravity-Pneumatic Waste Handling Systems.

3-5.4.1 Each section of a gravity-pneumatic system shall conform to the requirements for the individual type of system.

3-5.4.2 The storage area above the metering valve in a gravity-pneumatic system shall be protected by automatic sprinklers.

3-6 Service Opening Rooms.

3-6.1 Every service opening shall be enclosed in a room or compartment separated from other parts of the building by wall, partition, floor, and floor-ceiling assemblies having a fire resistance rating of not less than 1 hour with openings to such room or compartment protected by approved self-closing fire doors suitable for Class B openings.

3-6.2 If entrance to a limited access service opening room is gained by a key, the service opening door need not require a key to be opened. One or the other shall be keyed.

Chapter 4 Linen (Laundry) Chutes or Conveyors

4-1 General.

4-1.1 Definition. Linen chutes or handling systems are chutes or systems used to transport soiled laundry from the floor or area of collection to a laundry.

4-1.2 Classification. There are three types of linen (laundry) handling systems involving conveyance through a tube or cylinder.

4-1.2.1 Gravity-type Linen Chutes. A gravity-type linen chute of this type is an enclosed vertical passageway in a building where the linen is transferred by gravity to a chute terminal room or collecting facility or a pneumatic system.

4-1.2.2 Pneumatic Linen Handling Systems. A pneumatic linen handling system is a vertical, horizontal, or inclined duct having sufficient mechanically applied air flow to convey linen without clogging to a laundry or collecting facility.

4-1.2.3 A gravity-pneumatic linen handling system is a system using a combination of the types defined in 4-1.2.1 and 4-1.2.2.

4-2 Construction.

4-2.1 General.

4-2.1.1 Linen chutes supported at intervals by the building structure shall be provided with expansion joints between support levels.

4-2.1.2 A linen chute shall extend (full size) at least 4 ft. above the roof of the building. The chute shall be open to the atmosphere.

4-2.1.3 Vertical linen chutes shall be enclosed on all stories above the collection or laundry facility within a continuous enclosure constructed of materials which are noncombustible, and extending from the ceiling of the collection or laundry room to or through the roof so as to retain the integrity of the fire separations as required by the applicable building code provisions. The walls of the enclosure shall have a fire resistance rating of not less than 1 hour if the building is less than 4 stories in height and not less than 2 hours if the building is 4 or more stories in height.

Exception: Masonry chutes conforming to 3-2.2 or constructed of masonry walls having a fire resistance rating not less than specified above shall not be required to be enclosed.

4-2.1.4 Metal linen chutes or handling systems shall be made of stainless steel or galvanized or aluminum-coated steel with no screws, rivets, or other projections on the interior surface of the chute. Laps or joints shall be of a design so that liquid will drain to the interior of the chute.

4-2.2 Gravity Linen Chutes.

4-2.2.1 The portion of a gravity linen chute located not more than 6 stories below the roof of a building shall be made of steel not lighter than 18 U.S. gage and any other portion shall be made of steel not lighter than 16 U.S. gage.

4-2.2.2 Gravity linen chutes shall be constructed straight and plumb with no offsets.

4-2.3 Pneumatic Linen Handling Systems.

4-2.3.1 Metal thicknesses shall not be lighter than 20 U.S. gage steel for material conveying lines, but in all cases shall be of sufficient thickness to retain its design shape under all operating conditions. Steel shall be galvanized, aluminized or stainless to avoid corrosion.

4-2.3.2 The minimum air velocity in a pneumatic linen handling system shall be not less than 5,000 ft. per minute.

4-2.3.3 Risers on pneumatic linen handling systems shall be equipped with dampers which are open to the atmosphere except when automatically closed to permit conveying operation in another riser. Immediately after completion of the conveying cycle, all riser dampers shall be opened.

4-2.3.4 Pneumatic linen handling systems operating on a dual waste-linen mode shall have two separate service openings (stations) at each location, one for rubbish and one for linen. These must be sequenced to allow only one charge in the system at any given time and must be interlocked electronically to convey material to its proper destination.

4-2.3.5 Dual pneumatic systems which handle other materials (such as waste) in addition to linen (laundry) shall be designed to operate in the waste mode in the event of electrical failure of any of the material diverter switch controls and immediately upon start-up after a scheduled or nonscheduled shutdown of the system.

4-2.3.6 Automatic fire dampers shall be installed at all points where the linen handling system penetrates fire-resistive par-